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EPIDEMIOLOGY OF PLAGUE

In 1952[1] *and 1953,*[2] *the research team of the Institut Pasteur de l'Iran published the results of its work in the inveterate plague focus of Kurdistan. The authors put forward a number of new ideas which, they felt, could be applied in other foci and help solve remaining problems in the epidemiology of the disease.*

Investigations of plague epidemiology in eastern Mediterranean countries (Turkey, Syria and Iraq), India, and Java, carried out with the assistance of WHO at the request of the governments concerned, have enabled the research workers of the Institute to test their ideas themselves. A report on these surveys appeared in a recent issue of the Bulletin of the World Health Organization.[3]

In the article that follows, Dr M. Baltazard discusses the main points of this report.

The first modern epidemiological studies of natural plague suggested that the disease was due solely to highly susceptible rodent species, because of the spectacular epizootics among these species. The rodents concerned were either domestic ones, headed by the rat, the main cause of human plague, or wild or field species, such as the gerbils in South Africa and the Sciuridae in the Asian or eastern European foci (tarabagans, susliks) and in the Americas (ground squirrels, prairie dogs). It is true that, in these rodent populations, plague always had a tendency to die out because of the very violence of the epizootics. That this disappearance was complete was suggested by the negative results obtained in all investigations of these populations during inter-epizootic periods. However, the continual recrudescence of the disease at the same places in wild foci, and its never-ending persistence in certain rural or urban foci, where the rat was thought to be the only rodent involved, seemed proof of its perpetuation by these highly susceptible species.

A new theory

In 1952, the Institut Pasteur de l'Iran, on the basis of its researches in Kurdistan, introduced the new idea that highly resistant species play a part in plague epidemiology. The research workers of the Institute enunciated the following basic principle: any species exterminated by a disease cannot be the reservoir of this disease, or, in other words, the true reservoir of a disease must be sought not among the most susceptible species but among those whose natural resistance shows them to be the best adapted to the disease. This principle, which may appear self-evident, was in fact directly opposed to accepted ideas, particularly in the case of plague, where resistance to infection had always been considered as a factor limiting its spread.

According to the new theory, the true reservoirs of infection were the highly resistant rodent species and the susceptible species were only temporary victims. Once these susceptible species, and in particular the rat, were regarded as unable to perpetuate the disease, the whole problem of plague epidemiology had to be reconsidered, especially in the case of the so-called "pure murine" foci (India, Java, Madagascar, Kenya, etc.).

Investigations

The new concept found a very wide audience. In Kenya, R. B. Heisch was the first to prove that, in one of the most reliably

[1] *Bull. Wld. Hlth. Org.*, 1952, **5**, 441
[2] *Ann. Inst. Pasteur*, 1953, **85**, 411
[3] *Bull. Wld. Hlth. Org.*, 1960, **23**, 141

established " pure murine " foci anywhere in the world, *Rattus rattus* played no part in maintaining the disease and autonomous wild rodent plague existed, based on highly resistant species. In the USA, investigations in the inveterate western foci were directed, at the instance of K. F. Meyer, towards species resistant to the infection and rapidly revealed the primary role played by some of them (Microtinae, Cricetinae). In the USSR, despite the firmly held belief that marmots and *Citellus* (susliks) played a predominant role, a number of workers turned their attention to the resistant species. Gerbillinae, including several species of *Meriones* and the gerbil *Rhombomys opimus*, Cricetinae (*Cricetulus*), Microtinae (*Alticola* and *Microtus*) and even Lagomorpha (*Ochotona*) were then incriminated. These species, which for the most part had already been recognized by Soviet workers as being subject to infection and whose resistance was known or had recently been demonstrated, are now considered [4] to play the principal role in most areas of permanent infection.

Finally, WHO gave the Institut Pasteur de l'Iran an opportunity to extend its investigations by entrusting it with a series of epidemiological surveys requested by the Governments of India, Java, Iraq, Syria and Turkey. These surveys took place from 1954 to 1957, in collaboration with national teams, the Institute meanwhile continuing its work in Iranian Kurdistan. This group of investigations, in conjunction with those commenced in Morocco in 1941 by the Institut Pasteur du Maroc, under the leadership of Georges Blanc, covered practically all aspects of plague throughout the world and made it possible to solve a number of controversial questions relating to the epidemiology of the disease.

Permanent foci

The Institut Pasteur de l'Iran had originally announced that the Kurdistan focus was " a focus of pure *Meriones* plague ". Classifications by taxonomists specializing in the *Meriones* genus indicated the presence of three species only, which were shown experimentally to be highly resistant to plague. The workers of the Institute were thus led to carry to its extreme limit their theory of the predominating part played by resistance to the disease, by concluding that " plague can thus maintain itself only in highly resistant rodents ".

Further researches in Kurdistan were to show definitely that serious confusion existed in the classification of the genus *Meriones*, which had already been repeatedly modified by the experts. The Institute undertook the study and reclassification of the *Meriones* of Kurdistan, with help from biologists, cytologists and taxonomists. This reclassification revealed profound differences between the species of this genus, superficially so homogeneous. One of these differences was concerned precisely with susceptibility to plague. Four (and not three) species existed in Kurdistan, and were found throughout the area investigated, which had been extended in the meantime to Iraq, Syria and Turkey. Only two of these species, *M. persicus* and *M. libycus*, possessed the resistance regarded as the *sine qua non* for the continued persistence of the disease; the two other species defined in the course of reclassification, *M. vinogradovi* and *M. tristrami*, were on the contrary highly susceptible to plague. In each of the permanent microfoci studied in Kurdistan, there were at least one of the resistant species and at least one of the susceptible species, closely mingling in their habitat. Thus, while other workers were recognizing the basic role played by resistant species in plague among susceptible species in inveterate foci, the Institut Pasteur de l'Iran came to the conclusion that the presence of susceptible species able to start epizootic infection afresh among resistant species was necessary to maintain such foci. The main cause of the perennial nature of plague in inveterate foci could thus be defined as the presence of a resistant-rodents-susceptible-rodents complex.

However, research in temporary foci was to show that this was not sufficient cause in itself. The mere presence of resistant species could bring about only temporary persistence.

[4] Pastukhov, B. N. (1960) *Bull. Wld. Hlth. Org.*, **23**, 401

For perennial plague to occur, it was necessary to have a dense population of very highly resistant rodents capable of surviving the most violent epizootic plague in large numbers—i.e., sedentary rodents, able to maintain the infection in fleas, in deep, permanent burrows with a favourable microclimate.

Temporary foci

Encountered all over the world and throughout history, these foci multiplied at the time of the " modern pandemic ". They were characterized by a more or less prolonged period of persistence following the introduction of plague. This persistence, although suggesting that the disease was permanently implanted, was nevertheless followed by its complete disappearance. Responsibility for this temporary persistence had been attributed in most of these foci to commensal rats, and its relatively long duration, as opposed to the usual brief duration of the historical onslaughts of the disease, had been regarded as due to not very clearly specified climatic or local factors.

The survey carried out by the Institut Pasteur de l'Iran in Mesopotamia showed that, despite a history marked by frequent reappearances of the infection, the focus there was of the temporary type. Similarly, surveys in India and Java proved that the foci there, despite the uninterrupted persistence of plague for half a century, were also only temporary ones from which the disease would no doubt disappear in the very near future.

In all these foci, classified as " pure murine " foci, research showed that the domestic rat played no part at all in the persistence of plague in rural areas and proved that this persistence was brought about by certain species of field rodents. However, these species (*Tatera indica* in India and Mesopotamia, *Rattus exulans* in Java) had not the resistance to plague or the density and sedentary nature required to create permanent foci of infection. The epidemiological maps showed, and this was confirmed by the investigations, that plague was continually on the move in rural areas. It rarely persisted for more than a year at any one place, and continued for several years only in exceptional cases. This temporary persistence existed only in areas where resistant species predominated. In Java, for example, infection persisted only in regions where *R. exulans* was predominant; when plague broke out on the plains in rice-growing areas where only highly susceptible species were to be found, it rapidly subsided.

Phenomena of the same nature (intervention of a resistant species) would seem to explain the persistence of plague in certain ports, as opposed to its usual brief duration in inland towns. The presence in these ports, in addition to *R. rattus*, of the species *R. norvegicus*, which is considered to be naturally resistant to the infection and is not found in inland towns, might play a part in this persistence. Finally, the data on persistence in ports had, for the most part, been falsified by the frequent reintroduction of infection, particularly by shipping, during the period when they were established.

Spread of infection

The traditional theory according to which the rat alone was responsible for the genesis of human plague offered no satisfactory explanation of the way in which the infection advanced from village to village in India and Java, and, in general, everywhere where plague had appeared and had spread in rural areas. Indeed, ever since the beginning of the century, investigations had shown the extraordinarily sedentary nature of *R. rattus* whose area of movement was restricted and never extended from village to village. The " passive transport " of rats, which was known to be responsible for the spread of plague along railways or navigable rivers, was suggested as an explanation. However, systematic examination of peasants' carts and even of baskets carried from place to place soon showed that such " transport " did not occur in rural areas. There remained the somewhat fanciful suggestion that infected rat fleas were carried from village to village in clothing or objects and produce. Investiga-

tions in India and Java showed, however, that this occurred only rarely.

It was the discovery of field rodent infection in these foci that eventually explained the slow, regular advance of rural infection. Research showed that plague moved forward step by step, borne by field rodents, from field to field, from burrow to burrow, in thin epizootic trails winding across the countryside, infecting village rats in passing, and thus setting off murine epizootics which led in turn to human infection. The sporadic nature of infection in villages, i.e., the fact that in the midst of infected territory many villages remained free from the disease, was due to the capricious nature of these epizootic trails and not, as had been suggested, the chance small-scale " transport " of infected fleas by man.

The seasonal nature of plague

Another point which remained obscure in the epidemiology of the disease was the very curious phenomenon of " plague seasons ": in India, the incidence of plague drops greatly every year at the beginning of the hot season and rises again only after the end of the monsoon. Long and difficult experimental work carried out by leading experts under varying climatic conditions had shown that heat, particularly when combined with drought, influences the multiplication of fleas, their infection by plague and their vector potential. This explanation, however, did not fit in with certain facts: in certain countries, as for example Java, under climatic conditions practically identical with those obtaining during the monsoon season in India, plague was continuously present; in India itself, moreover, although plague declined considerably in the off-season, it nevertheless continued to exist both in urban and in rural areas.

The investigations of the Institut Pasteur de l'Iran showed, in fact, that in the rural areas it was only the spread of plague and not the disease itself which came to a standstill at the end of each spring. In the north of India, practically no more villages became infected later than the beginning of June. Village plague being usually of brief duration, infection had by then died out in the villages infected at the beginning of the season, and there was accordingly a rapid decrease in the number of plague-stricken villages. Observation showed, however, that in these villages the infection followed a " normal " course despite the heat and drought. The number of rats and fleas, and the incidence and duration of murine and human plague were apparently the same there as at the height of the season.

Research indicated that this seasonal phenomenon depended primarily on the field rodent factor: from May onwards all species of rodents in the fields commenced aestivation, closing themselves in their burrows and living on stored food reserves. Thus the epizootic ceased to advance in the fields and, at the same time, contamination of village rats came to an end. When the field rodents again became active, that is in mid-October when the monsoon floods had dried up, the epizootic revived in the fields and murine, followed by human, plague soon reappeared in the villages.

It is possible that if a study were to be made of the movements of rodents in towns during the hot season, it might reveal something of the same nature which would explain the seasonal cessation of the epizootic in urban areas.

Interseasonal persistence (carry-over)

This seasonal phenomenon raised another question: where and how did the infection persist during the " off-season " period which lasts for nearly five months? As regards urban plague, the question seemed to have been solved: at the beginning of the century the Plague Research Commission which worked in Bombay for a whole year (October 1905-September 1906) had shown that, although rat plague became rare during the off-season, it nevertheless did not cease to exist; studies by Indian research workers in the large ports subsequently confirmed this. In the rural areas, the degree of persistence of plague (human cases, murine mortality) in the few villages where the disease appeared at the

end of the season and was able to maintain itself throughout the off-season was considered sufficient to ensure the carry-over of plague from one season to the next.

The investigations of the Institut Pasteur de l'Iran showed that in the rural areas, even at the height of the infection, this carry-over phenomenon was too rare and scattered to explain the large number of points where plague revived at the beginning of the following season. Moreover, an epidemiological chart, covering four so-called " endemic " districts over the previous thirty years, indicated large areas each year where no village showed the carry-over phenomenon: nevertheless, plague reappeared in these areas at the beginning of the next season. For the most part, it reappeared not in the villages which were the last to be infected at the end of the previous season, but in villages nearby or even a few kilometres away, in areas which had remained free from infection during the preceding season. Finally, investigations in several villages revealed a high murine mortality rate, which confirmed the extreme rapidity with which the infection normally disappears in the case of the rat.

These investigations also showed the part played by field rodents. The gerbil, *Tatera indica*, which was the most common of these rodents in the plague area, resisted infection in sufficient numbers in the territory attacked by the epizootic to maintain flea infection during the hot season in its deep, closed burrows, where it was sheltered from unfavourable climatic conditions. Study of the regions flooded each year by the monsoon confirmed the role of this rodent: at the beginning of each season, plague first reappeared in these regions in villages situated on higher land which could not be flooded and where the gerbil burrows had escaped destruction.

Giving this explanation of the persistence of rural plague in which the domestic rat played no part, the research workers of the Institut Pasteur de l'Iran suggested that, in urban areas, the rat might well be able to find conditions lacking in the villages, in respect of numbers and distribution, breeding places protected against climatic conditions (cellars and drains), and the presence of populations or individuals resistant to the infection.

Epidemic development of plague

Immediately after Simond's discovery of natural plague in wild rodents, the work of the Plague Research Commission in India and of the Dutch in Java, confirmed by numerous investigators all over the world, firmly established the theory that the rat alone was involved in the genesis of human plague. Every case of human bubo-septicaemic plague was thus due to the bite of fleas from rats which had died of the disease. However, this theory did not explain everything. Although it was indisputably true for modern plague, in the form then prevalent in India or Java, for example, the fact remained that in those countries the infection was endemic rather than epidemic in nature, and spread slowly unlike the sudden, explosive outbreaks of the past. On the discovery, somewhat later, of the first foci of wild rodent plague where rats were not involved, investigations showed that human plague was rare or exceptional in these foci. It thus seemed certain that bubo-septicaemic plague epidemics did not occur in the absence of the rat, the only rodent able to introduce *Xenopsylla cheopis*, which experimental research has shown to be the best vector of the disease, into the human habitat.

The studies of the Institut Pasteur du Maroc in 1941, in a focus where human plague was present in its " historical " explosive form, were to reveal the role played by human ectoparasites in the development of epidemics. Nevertheless, the presence of the rat in this Moroccan focus, the simultaneous existence of a violent murine epizootic, and the presence in houses, in the very clothing of persons who had died from plague, of infected *X. cheopis* led most epidemiologists to dispute the findings of the Moroccan workers.

The first publications of the Institut Pasteur de l'Iran raised anew the question of interhuman transmission in regard to the Kurdistan plague focus, a wild rodent focus without rats where there had never-

theless been epidemics of bubo-septicaemic plague.

Further research by this Institute was to provide a solution for the problem. It confirmed the extreme rarity, if not absence, of human ectoparasites in rural areas in India as in Java. At the same time, however, it showed that plague was not—and in fact never had been—of an epidemic nature in the particular environment concerned. The history of the human infection, which was studied in a large number of villages, showed that plague caused only a series of spaced, sporadic cases there, and that these were few in number at any one time. The epidemic aspect of plague in India and Java was only a statistical one, the systematic addition of cases by canton, district, province, etc., giving enormous figures in periods when the disease was distributed over a wide area.

On the other hand, investigations in the rural foci of Syria, Turkey and Iraq, where human bubo-septicaemic plague had on many occasions taken on the same " historical " epidemic aspect as in Iranian Kurdistan, revealed the same complete absence of the rat and the same high density of human ectoparasites. Proof of interhuman transmission in these foci was obtained in Iran where, during a village epidemic, the plague bacillus was isolated from specimens of *Pulex irritans* captured in the houses of persons who had died from bubonic plague ten days beforehand.

The controversy regarding the way in which plague becomes epidemic was thus complicated by the application of the word " epidemic " to two different phenomena. The creation of the word " anademic " was suggested to designate the addition of sporadic cases as opposed to the multiplication of cases by the process of interhuman transmission leading to an epidemic.

The decline of plague

The decline of plague throughout the world over the past 15 years has been large scale and rapid, though this in no way means that plague can be written off. It marks, however, the close of a unique period in the history of plague—the period of the " modern pandemic " in which the invention of the steamship enabled the disease to spread throughout the world. Today's situation reflects the success of a gigantic attempt—the first that could really be called " international "—to make good one of the most tragic consequences of human " progress ".

From the beginning of the century, the successive sanitary conventions imposed increasingly heavy obligations on the ever growing number of countries bound by them. Measures involving enormous expenditure of effort and money were continued for years with a tenacity all the more meritorious in that the results were always disappointing; these measures included the search for and systematic examination of rats in ports and on vessels, the destruction of refuse, the separation of drains in ports, attempts to prevent the embarkation and disembarkation of rats and, in particular, the employment of rat poison and the periodic fumigation of ships.

It was the application of " rat-proofing " that finally led to the gradual elimination of the rat from shipping. The value of this method, conceived and applied in the USA as early as 1907, was only officially recognized in 1926, when the Paris Conference introduced deratting exemption for rat-proof vessels into the International Sanitary Convention. It did not become really general until just before the Second World War. Not only does rat-proofing eliminate *R. rattus* from vessels at sea, but its application to new buildings is also gradually eliminating the species from the large ports as they become modernized. At the same time, the resistant species *R. norvegicus*, which is unaffected by modernization at the ports, is multiplying. The antagonism between the two species is helping to bring about the complete disappearance of *R. rattus*. The world-wide decline of the infection is commencing; one after the other, a number of foci, which appeared to be firmly established, are dying out. Bit by bit, plague is losing the ground it gained temporarily during the half-century of the modern pandemic, its latest and most spectacular losses being in India and Java.

The fate of plague

Nevertheless, plague still clings to those positions where biological conditions have favoured its permanent establishment. Our present knowledge of these conditions enables us to identify most of the foci concerned and to measure their considerable extent: during half a century, plague, by increasing the number of its permanent foci, has more than doubled its area of distribution, now on a world-wide scale as a result of territorial gains such as those in South Africa and the Americas.

However, it can safely be affirmed that the disease will never again have the opportunity it had at the beginning of the modern pandemic: it has been banished from the high seas and the great ports have been closed to it. On the seas, plague is now carried—as in the past—only in coastal waters, by small boats which are neither rat-proof nor deratted, and between ports still without facilities or supervision. Such ports, however, are still in the majority, and all over the world lighters, junks, sampans and coasters of all kinds remain rat-infested: oceanic plague has disappeared but maritime plague remains and certain areas offer it the same scope as it had in the past. It is safe to say that there will never again be a plague pandemic; it is certain, however, that, with its inherent epidemic tendencies, the disease will occasionally flare up in localized outbreaks and show that it is still a force to be reckoned with. While plague is at present quiescent, this must not blind us to the fact that the positions it holds are stronger than ever; entrenched within reach of all the strongholds of modern civilisation, it may well be a disease of the future.

Recent gains in knowledge permit us to have a better idea of this future. It seems certain that the introduction of murine infection into a plague-free area can only occur where *R. rattus* exists, and that the ensuing epizootic will be brief if *R. rattus* alone is present and can only be prolonged if *R. norvegicus* is also found. It would seem certain that a focus can develop only where the infection can become established in wild or field rodents. This focus will be only temporary if too low a resistance and too high a mortality among these rodents prevent the infection from settling in one place and force it to keep moving into new areas in order to survive. On the other hand, inveterate foci will develop where sufficiently resistant species occur and a balance of infection is maintained between resistant and susceptible species.

Prophylaxis

Our better knowledge of the means whereby plague can spread should also make it possible to define control measures more clearly. In respect of quarantine, prophylaxis of the human infection remains unchanged, since the International Sanitary Regulations have wisely retained, through successive modifications, the provision specifying disinsection of patients and suspects as well as of their baggage, bedding and linen. Thus, the principle of preventing the interhuman transmission of bubo-septicaemic plague by human ectoparasites, whose importance has been shown above, has been safeguarded. Similarly, the prevention of murine infection by rat-proofing or traditional deratting, as defined in the International Sanitary Regulations, remains valid both for immediate and long-term prophylaxis.

Nonetheless, the WHO Expert Committee on Plague recognized that the Institut Pasteur de l'Iran was correct in pointing out the inaccuracy of the word " rodents " in certain definitions appearing in the International Sanitary Regulations. The Committee recommended its replacement by the word " rats ", thus specifying that only those areas where rat plague is active (and not, for example, permanent plague foci among wild rodents without murine plague) should be declared " infected local areas " and treated as such from the quarantine standpoint.

For immediate national and long-term international prophylaxis, far-reaching changes in the accepted regulations are necessary. As regards immediate prophylaxis, there should be no deratting, which is a waste of time, labour and money; it should be replaced by the thorough disinsecting of houses and their occupants, thus breaking in one

operation the chain of infection from rat to rat, from rat to man, and from man to man. There should be no vaccination, which is too slow and unreliable for immediate prophylaxis, but chemoprophylaxis by means of sulfonamides. There should be no *cordon sanitaire* or isolation measures, since these are rendered pointless by disinsecting, chemoprophylaxis of contacts, and treatment of patients with sulfonamides or antibiotics.

As regards long-term prophylaxis in infected territory, once it had been demonstrated that wild or field rodents alone play a part in the maintenance and propagation of the infection, it seemed logical to carry out eradication campaigns based on the destruction or at least disinsection of field rodents and their burrows. Because of certain prejudices arising from previous failures, public health authorities were at first reluctant to undertake such campaigns, but the success of those carried out in certain inveterate foci in the USSR showed that they were the only means of obtaining lasting results.

Where long-term prophylaxis at the international level is concerned, certain definitions (as in the case of yellow fever) appear to be called for, i.e., the definition of "receptive areas" as those where *R. rattus* exists side by side with a sufficiently numerous and vulnerable field rodent fauna; of "critical areas" as inveterate wild foci together with the ports, even if free from infection, situated in their neighbourhood; and, finally, of "immune areas" as areas free from *R. rattus*, together with the neighbouring ports. These definitions might permit the immediate preparation of agreements for international assistance in the event of the invasion of a "receptive area" by plague. In this way the threatened country could be provided with everything necessary to ensure the rapid eradication of the disease before it had time to take root and spread.

An international programme for the detection and delimitation of "critical areas" should be drawn up, making it possible to designate "infective ports" and to plan the eradication of plague in the areas concerned. In the third report of the WHO Expert Committee on Plague,[5] a programme of this type headed the Committee's "Recommendations for co-ordinated research".

[5] *Wld Hlth Org. techn. Rep. Ser.*, 1959, 165

AIR POLLUTION

In December 1952 many parts of the British Isles were covered by an anticyclone. It was cold, and fog was widespread, particularly in and around London, which remained blanketed in it for five days. Within about 12 hours from the beginning of the fog the morbidity rate in the Greater London area became very much higher than usual for the time of the year. The common form of illness experienced was characterized by a relatively unproductive cough, nasal discharge, sore throat, and sudden attacks of vomiting, and was especially severe in persons who had had a previous history of chest trouble. In the very ill, dyspnoea, cyanosis, moderate fever, and râles and rhonchi indicative of bronchospasm and the presence of bronchial secretions were present. Men were affected more than women, and most of the sick were over 45 years of age. There were appreciably more hospital admissions than usual, particularly for cases of acute respiratory infection but also for heart disease. The mortality records showed that, during the week of the fog and the week after, there were 4000 deaths more than the average. Most of the people who died were recorded as having had chronic bronchitis, bronchopneumonia, other lung disease, or disease of the heart.

During the fog the smoke concentration was found to be five times greater than at other times; the sulfur dioxide concentration about six times greater. A Committee on Air Pollution set up in 1953 by the Government of Great Britain "to examine the nature, causes and effects of air pollution and the efficacy of present preventive measures"

held that, while the evidence did not provide a clear indictment of any one constituent of the fog, the conclusion was inescapable that the excessive mortality and increased incidence of respiratory infection during and immediately after the fog were the result of irritation of the respiratory tract by contaminants of the fog—the irritants mainly responsible probably being derived from the combustion of coal and its products and their lethal effects being almost wholly exercised on persons suffering from chronic respiratory or cardiovascular disorders.

This was not the first time that air pollution has been blamed for producing ill effects on health in London. The English Parliament had passed an act as long ago as 1273 forbidding the burning of coal in London, and in 1306 a man was executed for doing so. The law quickly fell into abeyance as the shortage of wood as fuel became more pronounced, and when the Industrial Revolution came attempts to prevent the pollution of the atmosphere were unavailing. Towards the end of the nineteenth century big increases in mortality occurred in association with periods of severe fog in 1873, 1880, 1882, 1891 and 1892.

Air pollution and its evil effects were not, and are not, confined to England, the home of the Industrial Revolution. There was a notorious occurrence in 1930 in the Meuse valley in Belgium, associated with anticyclonic conditions, cold, fog, and heavy industry. In 1948 the industrial town of Donora, USA, some 30 miles south of Pittsburg, was afflicted by a heavy fog from 27 to 31 October; 5910 persons (42.7% of the population) fell ill, 15.5% mildly, 16.8% moderately, and 10.4% severely; 17 persons died. There was also the Poza Rica incident of 1950 in Mexico. Mention should be made, too, of the recurrent "smog" of Los Angeles, occurring during the summer and early autumn and causing irritation of the eyes, nose and throat, damaging vegetation, and making the atmosphere hazy.

Wherever men collect they tend to pollute their environment. Throughout human history towns have been concentrations of refuse and dust, with rivers and wells polluted by waste materials, and ground water contaminated—and, as a corollary, they have been breeding-grounds for vermin and bacteria and centres of epidemics. The dangers of impure water and the indiscriminate disposal of sewage and refuse have slowly been recognized, however, and it is safe to say that practically all towns of reasonable size in the world pay at least lip service to the ideals of pure water and sanitary disposal of sewage and refuse.

Only relatively recently has so much attention been paid to pollution of the air. The biological processes of living matter, certain natural phenomena and many of man's activities—especially since the Industrial Revolution—result in the liberation of gases, vapours, dust, and aerosols of suspended particles into the air, and some of these atmospheric contaminants are harmful to health. The study of the nature, properties, and behaviour of the contaminants is difficult, and requires the co-operation of physicists, chemists, and biologists; the polluting gases and vapours may form a proportion of only a few parts per million or even one part per thousand million or less, but the toxicity of some compounds in the parts per thousand million range may be greater than that of others in the parts per thousand range. Some of the contaminants have not been identified, and it will be years before full information becomes available on many aspects of air pollution, so complex is the subject, so many and changing the factors involved. Whereas the industrial hygienist works in a semi-closed atmosphere where concentrations are higher than in the street, and conditions are somewhat simpler, so that sampling processes lasting only a few minutes are usually sufficient to give him a picture of what is taking place in the factory, sampling processes in the open air must usually continue for months and often for years before the factors involved in air pollution are understood. Thus the forms of pollution encountered in Los Angeles since 1945 are still not well understood, although measurements have been proceeding for over ten years.

Nevertheless, an appreciable amount of knowledge exists about air pollution and its

effects on human health. This knowledge is summed up in a WHO monograph that has just been published.[1] In this volume, which is the work of an international group of experts, a historical review of atmospheric pollution is followed by sections on sampling and analysis of the contaminants, the instruments used, the physical and chemical nature of air pollution, the role of meteorology, the effects of air pollution on human health, animals, and plants, the economic and social aspects of air pollution, the control of pollution by site selection and zoning and by process changes or equipment, fuel selection and utilization, air pollution legislation, standards, and enforcement, and finally—and topically—radioactive pollution of the atmosphere.

By the end of the nineteenth century practically everything that is now known about the causes of smoke—the visible cloud of suspended carbon particles that is the first and most obvious of the pollutants of the air—and its elimination had already been said in Great Britain. But smoke was not eliminated because it is a by-product of activities producing goods and profits and thus commanding the attention and support of financial interests. Moreover, the damage done by smoke, though considerable, was not very clearly visible to the individual smoke producer because widely spread, and since the damage was due to a large number of small producers a clear relationship between cause and effect was not easy to establish; nor, for the same reasons, could the blame readily be pinned upon definite persons who could be asked to remedy the situation. In American cities a few decades later it was found that even when public opinion was convinced of the need for smoke reduction there was reluctance to take the necessary measures, the attitude always being that the responsibility for doing so was someone else's. Circumstances have helped some countries in the campaign to abate the smoke nuisance : in the USA supplies of oil and natural gas, which burn with little or no smoke, became more freely available. Even so it became necessary for states and municipalities to pass laws to make it compulsory for householders and industries to burn smokeless fuels or to use more efficient equipment to burn fuel. In Great Britain there was no natural gas; oil had to be paid for in foreign currency; and even if industries could be compelled to install more efficient machinery for getting rid of smoke the main problem would be to prevent the domestic consumer of coal from continuing to burn it wastefully in open grates. A considerable proportion of the air pollution of the great fog of 1952 in London was attributable to smoke from fires burning in innumerable open grates throughout the metropolis.

Smoke is not by any means the only atmospheric pollutant. Grit and dust, sulfur dioxide from coal and smelters, hydrochloric acid from such processes as the production of sodium carbonate from common salt, hydrogen sulfide from tar distillation, nitrogen dioxide from the chamber process for sulfuric acid, hydrogen fluoride from the production of superphosphate and aluminium, lead, arsenic, zinc and copper derivatives from the metallurgical industries, finely divided beryllium from the manufacture of radio valves, hydrocarbons, aldehydes, and olefines from combustion of oil, carbon monoxide from a variety of sources, all enter the air to join the sulfur dioxide, hydrogen fluoride and hydrogen derived from volcanic disturbances, the hydrogen sulfide from seepage of natural gas, volcanoes or action of sulfide bacteria, the ozone formed photochemically or by electric discharge, the dust and aerosols consisting of salt particles from sea water, particles from soil and vegetation, dust of meteoric origin, bacteria spores and pollen. The concentration of the substances not contributed by man is extremely low, except in the immediate vicinity of natural sources, but the concentration of those contributed by man can, meteorological conditions aiding or in the industrial centres themselves, be high enough to be injurious to health, and has been the subject of much industrial legislation. This legislation has on the whole been concerned with conditions in the factory or workshop

[1] *Air pollution* (*World Health Organization Monograph Series*, No. 46), 1960, Geneva

itself, not to any great extent with conditions outside.

The complete list of atmospheric contaminants that are harmful to the health is not known. In Los Angeles it was at first thought that sulfur dioxide was the main irritant in the smog, but now the list of substances currently considered to be causally related includes as well oxides of nitrogen, aldehydes, ketones, acids, chlorinated hydrocarbons, acroleins (or an " acrolein-like substance "), chlorinated aldehydes and related substances, formyl compounds, ozonides and peroxides of hydrocarbons of the series present in gasoline (especially the straight-chain hydrocarbons containing double bonds), ozone, nitro-olefines, peracylnitrites, organic free radicals, and carbon suboxide. This is a formidable list, but it is not exhaustive. It is considered that the gases and aerosols discharged into the air may not be irritant in themselves but may be acted upon by the ultraviolet rays of the sunlight and the resulting syntheses may be the smog-forming substance or substances. The present view is that the oxides of nitrogen and hydrocarbons (mostly olefines), both arising from combustion processes, especially of petroleum products, are involved in the photochemical changes that take place, with appreciable increase of the amount of ozone, in the air. In other words, more important than the combustion of coal and allied products—which were the main cause of the London fog of 1952—is the combustion of gasoline by the well over 2 million motor cars in Los Angeles, with their consumption of over 5 million gallons of gasoline daily.

A great deal remains to be found out about the effect of atmospheric contaminants on the human body. The biochemical reactions they produce vary: they may corrode, like sulfuric acid; or react with cellular proteins, like the aldehydes. They may be strong oxidizing agents, like ozone, or interfere with enzyme systems within the cell. They may, like the nitro-olefines, affect the eyes and the lungs. They may act on the upper part of the respiratory tract, or aerosols may aid the irritants to gain access to the lower part. Irritation of the upper part may cause reflex spasm of the distant bronchioles and severe symptoms, and very fine particles, generally classified as " inert ", may cause bronchoconstriction, apparently by virtue of an unexplained local irritant action. The lining of the bronchi may suffer from interference with its cleansing system, and the secretory rhythm of the mucous glands may be impaired; or there may be severe inflammatory response in the mucosa, with desquamation of the surface epithelium. Hypersensitivity and hyperirritability may occur. The reports on acute air pollution episodes indicate that the damage was due to local action of the pollutants on the exposed membranes, and that, when the respiratory tract was affected in some susceptible persons, secondary adverse effects on the heart became manifest. The short-term effects of an increased concentration of atmospheric contaminants on persons suffering from previous disease of the lungs or heart have been shown in the London and Donora episodes; what the long-term effects of these contaminants in lower concentrations may be both on those with previous disease and those without still remains to be elucidated. Among the possible effects is the stimulation of cancer.

Nor does air pollution affect only human health. The economic and social effects are considerable. Livestock and plants suffer; materials and their protective coverings corrode; houses and other buildings need increased maintenance, inside and outside; chimneys, and motors and other engines carry an unburnt residue; technical measures are required to suppress or reduce the smoke or emissions from factories; the removal of dust and the treatment of smoke mean increased use of electric power; transport costs go up in times of smog or fog; more electricity is used for lighting; pollution control requires the organization of a service to carry it out; research into the many complex problems of pollution cannot be done without funds. The social consequences are not easy to assess. In the United Kingdom, however, they may be seen in the drift of the population from the grimy, smoke-blackened towns of the North of England to the relatively less polluted South, with the vast effects on the community that this may have.

It must not be assumed that air pollution is confined to the industrial nations of Europe and North America, for industry is spreading throughout the world, carrying pollution in its wake. In Mexico City,[2] for example, the average visibility up to 1940 over the city was between 10 and 20 km; now it is hardly more than 4. During fine weather about 5 tons of dust and grit are deposited per square kilometre per week over the city (15 in the centre). Many tropical cities enjoy a climate of warm sunshine and gentle breezes; but this is a positive disadvantage as far as air pollution is concerned, because they are not, like so many industrial towns of more temperate zones, washed and ventilated by rain and wind.

Attempts to remedy air pollution date back in some countries to many years ago, but, as one contributor to the WHO monograph says: [3]

" With few exceptions air pollution control legislation in the various countries is inadequate. A frequent disadvantage is that the first control measures were introduced many years ago, and the legislation at present in force takes no account of the enormous growth of industry, new types of air contaminant, and new sources of pollution, such as motor vehicles and heating installations. Some laws provide solely for the payment of compensation for damage caused by air pollution."

In the United Kingdom a Public Health Act of 1936 constituted as statutory nuisances any industrial installation for the combustion of fuel that did not, as far as practicable, prevent the emission of smoke, and any chimney (except a chimney of a private house) emitting smoke in such a quantity as to be a nuisance. A local authority could serve notice on the offender requiring him to abate the nuisance, and if the notice were not complied with he could be brought before a court, fined, and ordered to comply. Local authorities could also make by-laws regulating the emission of smoke. Unfortunately, the local authorities often did not take action against offenders and failed to use their powers to make by-laws. As a result of the London smog of 1952, however, a Committee on Air Pollution was set up,[4] and a Clean Air Act was passed in 1956 that incorporated many of its recommendations. Under this act it is an offence to emit dark smoke from a chimney for longer periods that may be specified by the Minister of Housing and Local Government; no furnaces other than small ones for mainly domestic purposes may be installed, unless they can be operated, as far as practicable, continuously without emitting smoke; apparatus may be required to be provided to record the density or darkness of the smoke; and smoke control areas may be created. Other provisions cover the height of chimneys, mine refuse, road traffic, smoke from railway engines and ships, grit and dust, pollutants from chemical and other processes, and electricity generating stations.

In the USA there is no general legislation on air pollution, only state or local regulations; but almost every city now has some form of regulation, and it is often more stringent than the law in the United Kingdom, restricting the type and quality of the coals used in hand-fired furnaces and domestic heating appliances, the density of the smoke emitted, or the amount of grit and dust allowable. The result has been an astonishing improvement of the air in some cities, as for example in Pittsburgh.

In most other countries legislation is out-of-date and inadequate to deal with the situation:

" In the present state of knowledge, complete elimination of pollution is not practicable, but there could be much greater improvement than has so far been achieved. Such improvement will only be obtained by better legislation more effectively administered, increasing knowledge based on intensified research and development work, and a more determined public opinion. As new industrial processes are developed and conditions changed, modifications in legislation and methods of enforcement will be required from time to time; but it must be recognized that no one set of preventive measures will meet all

[2] *UNESCO Courier*, 1959, 3, 15

[3] Parker, A. (1960) *Air pollution legislation : standards and enforcement.* In: *Air pollution*, p. 365

[4] See page 426.

needs everywhere owing to differences in the conditions in various countries and localities." [5]

The study of the problem of air pollution has received a new impetus from the arrival of nuclear energy on the world scene, and the great expansion in the use of radioactive materials. The dangers of radioactivity are well known because of the mishaps that have occurred over the relatively long period in which X-rays and radium have been used; but these dangers have been confined to the laboratory and as much as possible mitigated. The release of radioactive waste into the atmosphere, with its possible effects both on the living and the unborn, has stimulated inquiry into the radioactivity of the air, factors involved in its differing concentrations, the fate of radioactive contaminants, radiobiology and radiotoxicology, methods of measuring maximum permissible levels, and ways of prevention. This inquiry must result in advances in knowledge of the other contaminants of the air, and it may be that concern about the consequences of radioactive pollution will lead to greater concern about the other forms of pollution as well.

The public health worker should be aware of the problem that air pollution represents. To give some figures for one of the countries where pollution is most serious: in the United Kingdom over a million tons of smoke are emitted yearly from domestic fires; half a million from industry; and 100 000 from the railways. Out of 900 000 tons of grit and dust liberated into the air domestic chimneys emit 100 000. Sulfur dioxide emitted amounts to 5.5 million tons (the domestic fires emitting nearly a million of this).[6] These figures give some idea of the extent of the problem in some countries and the uphill task involved in restoring some measure of purity to the air. It is a task that will need intensive research, the collection and dissemination of knowledge already acquired and to be acquired in the future, the creation of a special administration, the passing of appropriate legislation, and the training of officials in the methods of control. Above all, it will need the backing of public opinion. This can only be obtained by systematic education of the public, by inculcating the feeling that any emission of pollutants into the atmosphere is an offence that cannot be countenanced, whether the offender is industry or the private individual.

[5] Parker, A. (1960) *Air pollution legislation: standards and enforcement.* In: *Air pollution*, p. 380

[6] National Society for Clean Air (1960) *Clean air year book for 1960*, London (Quoted in *Nature*, 1960, 187, 200)

The Holy See supports malaria eradication

The Holy See has made a second symbolic contribution of $1000 to the WHO Malaria Eradication Special Account. On behalf of His Holiness Pope John XXIII, a cheque for this sum has been presented to Dr M. G. Candau, Director-General of WHO, by the Reverend Father Henri de Riedmatten, O. P., Ecclesiastical Adviser of the International Catholic Organizations' Information Centre, Geneva. In presenting the cheque, the Reverend Father de Riedmatten stated that it represents not merely a sign of approval of the malaria eradication campaign, but also an appeal to the generosity of Christians everywhere in favour of this campaign.

EPIDEMIOLOGICAL PROBLEMS OF DISAPPEARING MALARIA

When a malaria eradication campaign approaches the end of the attack phase and transmission has been substantially reduced, new problems arise. In particular, it is important to ascertain the exact amount of malaria still persisting in the community before deciding to discontinue regular spraying and start the consolidation phase. The classical methods of measuring malaria prevalence are inadequate for tracing the few remaining cases, and other methods have therefore been developed. An epidemiological factor of particular importance in the final stages of eradication is the part played by the asymptomatic carrier. An article on the subject by Dr. P. Yekutiel appeared in a recent number of the WHO Bulletin,[1] and is summarized below.

" An eradication programme requires continuous evaluation, starting either before or in the very earliest part of the preparatory phase and continuing until the end of the programme. The techniques to be used vary greatly at different stages of the programme... Once the phase of attack starts . . . evaluation must concern itself with malaria as a dynamic condition which is rapidly diminishing and later disappearing, and techniques adapted to this dynamic stage, many of them relatively new, must be adopted." [2] The classical method of the malariometric sample survey based on the determination of spleen and parasite rates offers no more than a purely static measurement of malaria prevalence at a given moment. The data it gives are certainly useful in the preparatory phase and in the first two years of the attack phase. But as soon as parasite rates have dropped to between 1% and 3%—usually in the second year of the attack phase—the indices furnished by malariometric surveys are no longer sensitive enough to measure further progress. What is needed is a method that will measure the prevalence of malaria in a continuous way and for the whole population. The " malaria case detection " method serves this purpose. It is based on the taking of blood slides from all fever cases encountered during regular visits to houses by antimalaria staff (" active detection ") or during consultations at dispensaries or fever posts (" passive detection "). The number of cases detected by this method during one calendar year, expressed as a proportion of the total population, constitutes the incidence rate, on which depends the decision whether to interrupt spraying and start the consolidation phase.

The fact that this method gives more precise results than the malariometric survey does not mean that it should replace it, for each method has its own uses. It is obviously impossible, for technical and financial reasons, to employ a case detection method covering the whole population right from the beginning. When this was done in programmes in the Americas, there was often a continual increase in the number of cases found, which almost always reflected growing coverage of the population rather than any real increase in malaria morbidity. As a result, it became impossible to assess the effects of spraying operations during the first two years.

A possible solution is to use malariometric surveys during the first two or three years for an over-all assessment, at the same time gradually building up malaria detection procedures so as to cover the whole population by the third year, when malariometric surveys will probably have reached their limit of usefulness.

Cessation of spraying

In the advanced stages of a malaria eradication programme, the problem of when to stop

[1] Yekutiel, P. (1960) *Bull. Wld Hlth Org.*, 22, 669

[2] *Wld Hlth Org. techn. Rep. Ser.*, 1959, **162**, 5

spraying arises. In this connexion, the seventh report of the WHO Expert Committee on Malaria specifies two criteria: " (*a*) interruption of transmission, and (*b*) reduction of the number of cases to zero or at least to a level so low that endemicity cannot readily be re-established."[3] In the opinion of the Committee, the reservoir of infection may be said to be practically depleted when no cases can be found in a reasonably intensive search.

The difficulty about these criteria is that they give no quantitative measurements for guidance. In a few places, " reduction of the number of cases to zero " was taken literally and spraying was unnecessarily prolonged. In a number of others, the decision to discontinue spraying was taken when malariometric sample surveys gave parasite rates of 1% or 2%; this proved premature and serious breakdowns occurred when the consolidation phase was already assumed to be established.

The level of incidence which would safely permit the decision to discontinue spraying must therefore be established. Experience has shown that, in areas where consolidation has successfully been maintained when spraying has ceased, the annual incidence rates per 1000 population have invariably been less than 0.5. Care must be taking in drawing conclusions from general rates, and the correctness of incidence figures should be confirmed by detailed field investigations.

Another factor to be taken into account before discontinuing spraying is the danger of reintroduction of infection by migrant groups. In regions where there are movements of population, it is advisable to continue spraying in areas considered as satisfactorily treated until the same position has been reached in neighbouring areas.

Stability of the consolidation phase

It will be clear from the foregoing that the situation in a consolidation-phase area cannot be considered satisfactory unless the annual malaria incidence is 0.5 per 1000 at the most. A higher figure often indicates the persistence of residual transmission, and means a greater number of cases than can be handled efficiently and rapidly enough to prevent the renewal of transmission in the absence of spraying. In the consolidation phase, investigation and radical treatment of every case are an integral part of the surveillance operations. If the number of cases is unduly large, these operations will break down.

Moreover, an annual incidence of 0.5 is permissible only at the beginning of the consolidation phase. Proper surveillance should reduce it steadily over a period of two or three years until total eradication is achieved.

Scope of case detection

Malariologists are in agreement that the number of blood slides examined in one year should represent a figure in the neighbourhood of 10% of the population, if case detection is to be satisfactory. Information based on smaller proportions of slides per population has proved unreliable in practice. In the majority of projects, the general annual fever rates have been between 10% and 20%, though the proportion of slides positive for malaria rarely exceeds 1% in the later stages of the attack phase. From the qualitative point of view, total coverage is essential; blood slides as well as general information must be received several times a year from all localities in the area of operations.

Asymptomatic carriers

In the later stages of an eradication programme, asymptomatic infections may be a cause of persistent residual malaria foci, which are extremely difficult to find and treat, particularly as case-finding is based chiefly on the symptom of fever. In certain endemic or hyperendemic areas where eradication had not been started, it was found that 83-94% of infections were symptomless at the time of blood examination. In countries at various stages of eradication, the proportion of infections without symptoms has ranged from 91% (Taiwan) to zero (Palma de Montechiaro, Sicily). In those where malaria was

[3] *Wld Hlth Org. techn. Rep. Ser.*, 1959, 162, 4

recently hyperendemic and where there still exists some residual transmission, the proportion of asymptomatic infections is comparatively high: in those where some time has passed since the interruption of transmission it is low. This suggests that some degree of persistence of the clinical tolerance originally acquired under hyperendemic conditions is the chief factor in the occurrence of asymptomatic infections.

From the practical point of view, the existence of a high proportion of asymptomatic cases in certain circumstances and phases of the eradication programme may warrant the use of different detection methods, such as mass blood surveys. In general, it should be possible to discover a large proportion of the asymptomatic infections by examining blood slides from all contacts of positive cases revealed in fever surveys.

Other epidemiological factors

Another factor influencing the epidemiology of disappearing malaria is the changing age distribution of cases. In an untreated or only partially treated area, children are most affected, but where transmission has been greatly reduced 50-90% of cases are in persons over the age of 15. As they stay at home more and travel less than adults, small children are better protected by residual spraying; infant parasite rates are therefore unreliable as indicators of the interruption of transmission, and case detection should be carried out as intensively among adults as among children.

One of the main problems in the later phases of malaria eradication is the elucidation of causes of residual transmission. Once causes related to inefficient operations —either spraying or case detection—or causes related to social factors like migration have been excluded, a very important task is the clarification of possible entomological factors: the existence of an exophilic secondary vector not previously recognized; development of behaviouristic avoidance by the vector; and changes in the vector's biting and resting habits.

CLASSIFICATION OF BRUCELLA

The increasing interest which public health authorities have shown in brucellosis during the last 25 years has encouraged research on the bacteria responsible for the disease. The controversial subject of *Brucella* classification has often been discussed in articles appearing in the WHO Bulletin as well as in the reports of the WHO Expert Committee on Brucellosis.

As early as 1928, Huddleson proposed biochemical criteria for dividing *Brucella* into three species (*Br. abortus*, *Br. melitensis*, and *Br. suis*). These criteria were based on variations in the resistance of *Brucella* to the bacteriostatic action of dyes added to an agar medium (thionine and basic fuchsin) and on its ability to decompose an organic sulfur compound into measurable amounts of hydrogen sulfide. Later on, serological criteria—typing by means of monospecific sera—were added. More recently, phage typing has been suggested as a further means of differentiation.

Most of the workers engaged in the systematic typing of hundreds of strains from all over the world, using biochemical and serological criteria, have encountered atypical strains that could not be classified. Huddleson et al. found 13 such strains among 2515 they studied between 1928 and 1942. Certain variants were found in regions very far apart. The variation in resistance to bacteriostatics noted by Wilson in 13 atypical strains isolated from infected animals and human beings in different parts of Europe was later found in strains isolated in the United States and in Switzerland. Variations observed in France were found to be similar to those discovered

in strains from cows in India and buffaloes in Java.

Several strains, isolated in France, had the characteristic biochemical properties of *Br. melitensis* but behaved serologically like *Br. abortus*. On the other hand, strains isolated in England corresponded to *Br. abortus* as regards biochemical properties, but reacted like *Br. melitensis* with monospecific sera.

Although the atypical strains are relatively few in number, their existence cannot be ignored. Moreover, differences in enzymatic and antigenic activity found within the classical species have given rise to the hypothesis that mutations occur. Characteristics have been known, in fact, to change under natural conditions (i.e., in the host). Is this due to induced mutation, or to the selection of already existing mutants ? There is doubt on this point, and extreme views have been put forward by some research workers —Renoux in particular—who believe that there is only one *Brucella* species and that the biochemical and biological differences between the strains are merely quantitative differences between varieties of one and the same species.[1] If laboratory procedures could be used to change, for example, all the characteristics of several strains of *Br. abortus* or *Br. suis* so that they could no longer be differentiated from *Br. melitensis*, or *vice versa*, then it would be justifiable to maintain that all *Brucella* strains were only varieties of a single species.

The WHO Bulletin will shortly publish results of investigations by I. F. Huddleson into the following questions. Can the characteristics so far used to identify the three *Brucella* species be changed by laboratory methods other than laboratory inoculation? If so, do these changes justify the conclusion that mutations occur, causing the transformation of one *Brucella* species into another ?

The experiments, which are described in detail, led to the appearance of variants which differed from the original strain only as regards the enzyme system governing the production of hydrogen sulfide. These variants seemed to be stable. Their properties were similar to those of atypical strains isolated from infected human beings and animals. Discussing his results, the author points out that the origin of the variants remains uncertain. Possibly small numbers of mutant cells existed in the parent strain, but the experiments do not exclude the possibility that the change was induced by the bacteriostatic dye.

Can such changes be referred to as mutations, since none of the other typical characteristics of the species have altered ? Certainly none of the results of this study confirms the hypothesis of a transformation of one species of *Brucella* into another.

The author stresses the importance of watching for any new strains, wherever they may appear, and examining their characteristics to determine whether any migration of *Brucella* species from one region to another occurs through infected hosts or any other means. It is also important to track down variants and determine their area of distribution and their frequency in a given region. The author feels that it would be illogical at present to discard the methods now used for classifying newly isolated strains—even if discrepancies in one or other of the differential tests are encountered from time to time—until more reliable methods have been developed.

In a forthcoming issue of the WHO Bulletin there will be a note by E. Sacquet and G. Renoux on an important aspect of the technique of cultivation on thionine medium. The experiments reported in the note showed that thionine gradually loses its bacteriostatic power for *Br. abortus*. It is roughly estimated that a Petri dish containing 1:80 000 of thionine and used six days after preparation has a bacteriostatic activity close to that of a freshly prepared dish containing 1:160 000 of thionine. The fall in the inhibiting power of thionine, which takes place at an unpredictable rate, may be responsible for certain atypical reactions of *Brucella* strains. It thus appears necessary for the bacteriostatic media used in identification techniques to be freshly prepared, and reports and publications on the subject should clearly indicate that this has been done.

[1] Renoux, G. (1958) *Bull. Wld Hlth Org.*, **19**, 739

ORIGIN OF DIARRHOEAL INFECTIONS

To detect the origin of an epidemic of diarrhoea in a group of people needs at times the astuteness and ingenuity of a detective: it means that every dietetic clue must be followed up, every link in the chain reconstructed, until the chain is complete and the person primarily responsible for the infection discovered. It is by no means easy to pin down the responsibility in every case.

Dr Joan Taylor, in a general study of the diarrhoeal diseases in Great Britain to be published shortly in the *Bulletin of the World Health Organization*,[1] describes several of the complicated cases that have occurred. There is nothing surprising about their complexity, given the variety of sources of *Salmonella* infection: animals, living and dead, meat products, fish products, eggs, milk, animal foodstuffs, fertilizers, etc. The table opposite gives some idea of this variety. In general, the serotypes of *Salmonella* most commonly found in man are those most widely spread among foodstuffs and among animals and their feeding stuffs. The concept of a "vehicle of infection" has been greatly expanded in recent years to include not only organic products liable to infection and the seasoning used for them but the apparatus and machines through which they pass while being prepared for the market, the air of the premises in which they are kept, and the people who handle them.

Dr Taylor mentions the case of the simultaneous outbreak of attacks of diarrhoea in several Edinburgh districts, the origin of the infection apparently being in a city bakery and restaurant.[2] The ingredients used for the cakes on which suspicion was focused (egg albumen, cream, etc.) were examined by the health services and found to be free of *Salmonella*. Only on a closer examination was it observed that, owing to superficial washing, a deposit of dried egg albumen still adhered to the metal edges of a mixer. This albumen contained *Salmonella*, and had contaminated the mixer, which was later used for other preparations. The origin of the *Salmonella* that had infected this deposit was never discovered, but with the removal of the deposit attacks ceased. In the same year other mysterious cases of *Salmonella* infection occurred. Little by little they were traced back to the milk of a sick cow that had not only infected the farm workers but also, through the milking-machine, contaminated the milk of healthy cows distributed for consumption. Some of these infections, which were due to *S. thompson*, were serious, and the patients had to be admitted to hospital. Several patients, although cured, continued to excrete *Salmonella* up to 11 weeks after the onset of the illness. Other cases cited by the author are of fish infected on landing by the sewage-contaminated water with which they were washed, and of human infection with *S. enteritidis* of unknown etiology. Several serotypes have been isolated in the pig, but we do not know how they pass from the living animal to man or what the intermediate stage is.

Salmonella are transmitted from one country to another by commercial products, particularly protein foods and fertilizers. *S. typhimurium*, the serotype responsible for 75-80% of *Salmonella* infections in England and Wales, has been found in egg products from England, Australia, China, USA and the Netherlands. The processing of eggs for commercial food products—the breaking of the shell, which introduces the organisms on the surface, drying, and conversion to powder—increases the risks of contamination. The processing of meat is open to the same risks. All that is needed to spread infection far and wide is one infected carcase in a slaughterhouse, or the inclusion in foodstuffs for cattle of infected substances unfit for human consumption (which will transfer the infection to the milk and thence to a community). Long delay before slaughter favours multiplication of the germs in the living animals and greater contamination of the carcase. The importation in some years of

[1] Taylor, J. (1960) *Bull. Wld Hlth Org.*, **23** (In press)
[2] Wright, H. A. et al. (1957) *Brit. med. J.*, **2**, 69

COMPARISON OF *SALMONELLA* ISOLATIONS FROM HUMAN SOURCES WITH ISOLATIONS FROM ANIMALS AND OTHER MATERIAL IN ENGLAND AND WALES, 1958 *

Salmonella type	Human	Animals	Products		
			Human foods	Eggs or egg products	Animal foods or fertilizers
Salm. anatum	55	Pigs 35 Dogs 4	English beef 4	Foreign egg products 8	Fish meal 2 Meat meal 1 Bone meal 15 Meal & bone meal 1 Pig starter mash or meal 1 Hoofs or hoof meal 1 Indian crushed bone 5 Fertilizer 1
Salm. bredeny	50	Pigs 3 Bovine 2			Fish meal 2 Meat meal 1 Bone meal 4 Indian crushed bone 1
Salm. derby	58	Pigs 1 Chickens 1 Dogs 1	Sausages or meat 1	English egg products 1	Chick meal 1 Meat meal 1 Hoof & horn fertilizer 1 Hoofs or hoof meal 5 Indian crushed bone 1 Fertilizer 1
Salm enteritidis	79	Pigs 1			Meat meal 1
var. *danysz*	1	Pigs 1			
var. *essen*	1				Fish meal 1
var. *jena*	32	Pigs 2 Bovine 1			Indian crushed bone 2
Salm. heidelberg	308	Pigs 2 Dogs 4	Sausages or meat 2	Foreign egg products 1	Indian crushed bone 1
Salm. newport	118	Pigs 2 Dogs 1	Australian beef 1 New Zealand mutton 1	Foreign egg products 12	Bone meal 10 Indian crushed bone 3 Fertilizer 1 Crushed bone 1
Salm. thompson	132	Pigs 6 Chickens 4 Dogs 1		Foreign egg products 227 English egg products 4	High-energy layer pellets 1
Salm.typhimurium	3097	Pigs 16 Bovine 10 Chickens 6 Dogs 1 Sheep 1 Turkeys 1	Sausages or sausage meat 3 Pork or pork luncheon meat 2 Pig's kidney 1 Cockles 1 Australian boneless beef 1 New Zealand boneless mutton 3 New Zealand frozen veal 5	Foreign egg products 143 English egg products 72 Miscellaneous egg products 19	Bone meal 9 Meat & bone meal 1 Hoof & horn fertilizer 1 Hoofs or hoof meal 3 Indian crushed bone 4 Fertilizer 1

* Partial reproduction of table accompanying Dr Taylor's article

goods infected with *Salmonella* led to cases occurring in England. In 1947, on the basis of the cases due to these imported types, the serotypes of *Salmonella* were classified into native and exogenous or imported. This distinction is no longer clear-cut, many serotypes existing concurrently.

The epidemiology of *E. coli* and *Shigella* infections is very different from that of *Salmonella*. Serotypes of *E. coli* pathogenic to man are rarely found in animals, and *vice versa*. Infection is direct from child to child or through the environment (objects or dust). It has been shown that a case of *E. coli* diarrhoea infects the immediate surroundings in 18 hours. As for *Shigella* infections, they seem to be transmitted from one person to another. The pathogenic organism can survive for several days in contaminated premises.

In her very full study Dr Taylor touches upon the question of host susceptibility, the human factor, which together with the other etiological factors determines the incidence and the seriousness of the infection. *Salmonella*, *Shigella*, and *E. coli* are found in perfectly healthy people. Debilitating conditions increase the risks of clinical infection. A cold, pneumonia, diabetes favour an attack of *E. coli* infection in children. *Salmonella* diarrhoea from an unnoticed or neglected infection in the mother on the day of the delivery may be fatal to a newborn infant. *Salmonella* meningitis may affect a premature infant. Pregnant women and animals are extremely susceptible to *Salmonella* infections. In none of these cases has the infection anything to do with food poisoning. It is difficult to assess individual resistance, but age, pregnancy, and debilitating conditions appear to be important factors in the production of clinical disease due to enteropathogenic organisms.

Health needs of the Congo

It will be recalled that, as soon as the emergency developed in the Republic of the Congo (capital, Léopoldville), WHO sent a mission to help organize the country's health services. A report from the WHO Senior Representative in the Congo describes the health situation there in mid-September. Medical care services appear to have suffered less than preventive services from shortage of medical personnel. It is important to consolidate the preventive services as quickly as possible so that the gains made in this field in recent years —particularly where insect-borne diseases are concerned—will not be lost. The French Government has made available four mobile health teams, each consisting of a doctor and a technician, for preventive work.

Many reports of small, localized outbreaks of smallpox continue to be received. The medical census teams, whose original task was to survey the health situation as a whole, have been asked by WHO to organize a vaccination service. The Government of Nigeria has donated 8 000 000 doses of freeze-dried smallpox vaccine.

In most areas, the routine treatment of leprosy cases is being continued by Congolese staff. However, it is reported that in some areas leprosy cases are leaving institutions because of food shortages and returning to their villages. There are also reports that mosquito breeding has increased substantially and the number of cases of malaria is growing.

Hospital services are being utilized to a greater degree, and the number of beds occupied at the main hospitals has increased. The national Red Cross teams continue to give extremely valuable service in the provincial and district hospitals, although some of them are working under great difficulties.

Intensive training courses for Congolese staff operating water purification plants have been started with help from WHO and bilateral assistance personnel. Attempts are being made to improve the distribution of medical supplies from Léopoldville to provincial and district centres, and supplementary despatches are being made by United Nations transport.

As a first step towards a long-term programme for recruitment of health personnel from abroad—until Congolese doctors can take over—WHO is helping to provide the Congo Government with the most essential staff for the basic medical services. Plans for intensifying the training of Congolese medical students are well advanced, and a scheme is being established whereby a substantial number of Congolese "*assistants médicaux*" will be able to take courses overseas in order to qualify as doctors of medicine.

Reports of Expert Groups

Rabies control *

The fourth report of the WHO Expert Committee on Rabies [1] has been prepared as a self-contained document, thus minimizing the need to refer to previous reports. Careful re-appraisal and modification of recommendations made in the third report [2] have been necessitated by the considerable body of new knowledge acquired as a result of research efforts during recent years.

Dealing with the prevention of rabies in man, the Committee points out that additional field experience has confirmed the effectiveness of combined serum and vaccine treatment of human beings who have been severely exposed to rabies infection, and emphasizes that this is definitely the best method now available.

The phenomenon of interference with the antibody response to vaccine by antirabies serum has been further demonstrated and possible means of avoiding it have been developed. In view of these findings slight revisions have been made in the Guide for Post-Exposure Treatment.

The development of an inactivated virus avian embryo vaccine (duck embryo), shown in experimental work to contain only minimal amounts of the factor or factors responsible for allergic encephalitis as compared with nervous tissue vaccines similarly tested, should help to reduce post-vaccinal nervous system reactions.

Rabies prophylaxis in man has long been a problem when it involves particular groups of persons with unusual risks of repeated exposure, for instance, veterinarians, field naturalists, or laboratory workers. For them, repeated exposure means repeated treatment, thus increasing the possibility of severe reactions to the vaccine, especially central nervous system reactions. There are now two types of vaccine available which are almost devoid of encephalitogenic properties, and a schedule of immunization with these is suggested by the Committee.

The most recent advance in the diagnosis of rabies has been the development of the fluorescent antibody technique, which, when properly used, can establish a highly specific diagnosis of test specimens within a few hours.

The Committee emphasizes the importance of prophylactic vaccination of dogs in the control of rabies. Immunity for at least three years can be conferred by a single injection of LEP Flury chicken-embryo vaccine. Recommendations are made on vaccination dosages for dogs, cats and cattle; and other control measures relating to stray dogs, domestic pets bitten by rabid animals, the international transfer of dogs and cats, and wild-life rabies are discussed.

Vampire-bat rabies continues to be a health problem in Latin America, and increasing numbers of rabies virus isolations are being reported from insectivorous and frugivorous bats in North America and south-eastern Europe. The Committee strongly warns against handling bats which appear to be sick or to be behaving strangely and recommends that persons bitten by bats in known infected areas should receive antirabies treatment.

Among other recent advances in rabies dealt with by the Committee are the availability of a new batch of international reference vaccine, the establishment of an international standard serum, and improvement of methods of production and concentration of antibody.

* WHO Expert Committee on Rabies (1960) *Fourth report* (*Wld Hlth Org. techn. Rep. Ser.*, No. 201), Geneva, 28 pages. Price: 1/9, $0.30, Sw. fr. 2. Also published in French and Spanish.

[1] Members of the Committee: Dr K. Habel, USA (Rapporteur); Dr A. Kemron, Israel; Dr H. Koprowski, USA (Vice-Chairman); Dr P. Lépine, France; Dr R. Schindler, Germany; Dr M. Selimov, USSR; Dr N. Veeraraghavan, India (Chairman). Representative of the Food and Agriculture Organization of the United Nations: Dr H. Könighöfer. Secretariat: Dr M. Abdussalam, WHO; Dr G. Bijlenga, WHO; Dr M. M. Kaplan, WHO (Secretary); Dr O. Ryberg, Sweden (Consultant); Dr E. S. Tierkel, USA (Consultant).

[2] *Wld Hlth Org. techn. Rep. Ser.*, 1957, 121

Notes and News

Regional Committee for Africa

The WHO Regional Committee for Africa held its tenth session in Accra, Ghana, from 8 to 13 August 1960, under the chairmanship of Dr P. M. J. Phillips (Ghana). Dr G. V. Kprotsra (Togo) was elected Vice-Chairman; the Rapporteurs were Dr O. B. Alakija (Nigeria) and Dr A. S. P. Tchoungui (Cameroon).

The session was attended by representatives of 30 countries, most of them newly independent or emerging states which had recently acquired or were about to acquire WHO membership. A special resolution was voted to enable certain of these countries which have become fully independent since the last World Health Assembly (May 1960) to retain their privileges as Associate Members.

In his report covering WHO work in the African Region since July 1959, Dr F. J. C. Cambournac, Regional Director, said that, owing to the rapid achievement of independence by many African countries, WHO was having to deal with an increasing number of requests. Fortunately a supplementary budget of $200 000 —out of which $160 000 was to be devoted to Africa—had been adopted by the last World Health Assembly to help newly independent states meet some of their most pressing needs. Dr Cambournac stressed that all progress in health should be accompanied by equal social and economic progress so that it might be possible to cope with the problem of overpopulation and prevent undernourishment and malnutrition.

On the subject of communicable diseases, Dr Cambournac said that optimum conditions for malaria and other diseases such as human and animal trypanosomiasis, bilharziasis and onchocerciasis still existed in Africa. Malaria was the most important disease in the Region, affecting almost its entire area with the exception of Basutoland. Nevertheless, in spite of difficult conditions in most parts of the continent, transmission of the disease had already been completely interrupted in some places, particularly in the forest areas of Cameroun and Liberia, as a result of vigorous and carefully planned campaigns carried out with WHO and UNICEF assistance. Remarkable progress had been noted in Zanzibar, Pemba and Mauritius, where the last phase of surveillance had been reached. A pre-eradication campaign had been started in the south-eastern part of the continent and would cover some 5 million people.

The fight against yaws and leprosy had reached an advanced stage, and in some areas once seriously infected by yaws the disease was no longer a public health problem. This applied particularly to Nigeria which included most of the 10 million people cured out of the total 20 million in the whole of Africa known to be affected a few years ago. Of the estimated 2 300 000 leprosy patients in Africa, over a million were under treatment.

The Committee endorsed the proposed programme and budget for 1962, which called for an expenditure of $1 773 000 under the regular budget of WHO, $2 594 000 from the Malaria Eradication Special Account, $851 000 from United Nations Technical Assistance funds, and $11 000 in other extra-budgetary funds. The staff assigned by WHO to the African Region in 1961 will be 283 in number, and an increase to 313 is foreseen for 1962. The number of projects will rise from 261 in 1961 to 287 in 1962 if all requests can be complied with.

The technical discussions at the session were on problems of environmental sanitation in Africa. The main points discussed were: water supplies; waste and sewage disposal; and training of sanitation staff. From the statements made by most participants, it appears that the sanitary situation is becoming very serious in many fast-growing African towns. However, the rural communities should not be forgotten when national plans are drawn up to provide adequate water supplies and sewage disposal facilities. A

primary difficulty in connexion with water supplies is that of finding the necessary funds. Qualified personnel are also needed for the proper maintenance of existing installations. A water supply system should in the long run pay back the money spent, so that the capital can be used for building other water supply systems in the country concerned. Some villagers still have to walk over five miles to get water which is polluted and brings disease. More sanitary engineers, sanitary inspectors and other allied personnel have to be trained to give advice to communities and enable them to devise simple and cheap means of improving their environment. The importance of health education was particularly stressed by all participants for it is not worth launching vast projects unless they have the support of the population, nor—to quote one participant—"building latrines if the people do not know how to use them".

The next session of the WHO Regional Committee for Africa will take place in Brazzaville, Republic of the Congo, in 1961.

Regional Committee for the Americas

The Directing Council of the Pan American Health Organization, which is also the WHO Regional Committee for the Americas, held its twelfth meeting (twelfth session of the Regional Committee) from 14 to 26 August 1960 at Havana, Cuba.

Representatives of 17 American Republics and of France, the Netherlands, and the United Kingdom took part in the session. Observers from Canada, the Organization of American States, UNICEF, UNESCO, and from various non-governmental organizations and other institutions were also present.

The Council elected Dr José R. Machado Ventura, Minister of Public Health of Cuba, as Chairman, and Dr H. van Zile Hyde (USA), and Dr Lisandro Latuf (Venezuela) as Vice-Chairmen.

The programme of work for 1961 approved by the Directing Council comprises 254 projects, to be carried out with the collaboration of the Pan American Sanitary Bureau (PASB), which acts as the WHO Regional Office for the Americas. The Pan American Health Organization's regular budget for 1961 amounts to $4 800 000, which represents an increase of $700 000 over that of 1960. In addition to its regular budget, the Pan American Health Organization also has available for its work the sums allocated in the WHO regular budget to the Region of the Americas ($1 891 500 for 1961) as well as the Technical Assistance funds, administered by WHO, for programmes in the same Region ($981 400), and other funds for specific purposes (malaria eradication, community water supplies the Institute of Nutrition of Central America and Panama, the Technical Co-operation Programme of the Organization of American States, and special subsidies), amounting to approximately $4 573 800. The total funds available for 1961 thus come to about $12 246 700.

The Council noted the proposed programme and budget for 1962, providing for the use of $5 240 000 from the PAHO regular budget. With the addition of the other funds administered by PAHO, the general total of the 1962 budget is about $12 994 700.

Presenting his annual report, Dr Abraham Horwitz, Director of PASB and WHO Regional Director for the Americas, stated that, during 1959, the Regional Office had particularly stressed the inter-relationship of health, welfare and economy. This question had already been raised by Dr Horwitz at the second meeting of the Special Committee for the Establishment of New Methods of Economic Co-operation (Committee of Twenty-one) of the Organization of American States, held in April 1959 at Buenos Aires, which recommended to governments that, in planning and negotiating the financing of economic development, public health programmes should be included, as these are essential and complementary to economic programmes. The Committee of Twenty-one also recommended that governments should obtain the technical advice of PASB in drawing up such programmes. The Council decided to request the Director of PASB to consult with the appropriate officers of the Organization of American States and of other organizations interested in or connected with public health, in order to study how the joint interests of these organizations in the economic field could be further developed.

On the subject of the economic aspects of malaria eradication, the Council decided: (*a*) to suggest to the Member Governments that, in their respective economic plans, recognition be given to the importance of the eradication of malaria in their territories and its significance for improvement in the standard of living, especially that of rural people who live in areas having a high incidence of this disease; (*b*) to request the Pan American Sanitary Bureau to study, in so far as budgetary limitations permit, the possibility of devising methods for the evaluation, by the Member Governments, of the economic and social significance implicit in the speedy elimination of malaria; (*c*) to recommend that the Member Governments consider the possibility of extending such evaluation services to include all the programmes conducted by their respective public health administrations.

In view of the interest aroused by the question of the relationship between health and economy, it was agreed to select " Methods of evaluation of the contribution of health programmes to economic development " as the topic for the technical discussions to be held during the next meeting of the Directing Council.

The subject of this year's technical discussions —to which one day of the meeting was devoted— was " Technical, administrative, legal and financial aspects of garbage and refuse disposal ".

On the basis of a report submitted by the Republic of El Salvador, the territory of that country was declared to be free from *Aëdes aegypti*. The representative of Colombia stated that his country hoped to submit a similar report at the next session. It was recommended that *A. aegypti* eradication campaigns be undertaken in countries which are still infested, and that those already in progress be intensified; countries in which the vector of urban yellow fever has already been eradicated were reminded of the necessity for maintaining strict vigilance in sea, air and land ports in order to prevent reinfestation.

With regard to malaria eradication, the Council expressed satisfaction with the measures taken by the various governments and by the Pan American Sanitary Bureau to solve the epidemiological and entomological problems encountered in the course of the campaign; it reaffirmed its interest in the programme and also requested Member Governments to continue their efforts to complete the eradication campaign in their respective territories, and thereby contribute towards the attainment of the goal of world-wide eradication.

On the question of smallpox eradication, the Council expressed the view that, although this disease has already disappeared from a number of countries of the Americas and is being eliminated in others by intensive vaccination programmes, there are still some countries in which the disease persists and where no such programmes have been undertaken. As this situation represents a serious public health problem for the Americas as a whole, the Council recommended that governments take the necessary steps to bring about total eradication of the disease

At one of the meetings, the Director of PASB submitted a volume containing all the scientific papers presented at the Second International Conference on Live Poliovirus Vaccines, together with the summary records of the proceedings of the Conference, held two months previously —from 6 to 12 June—in Washington.

Resolutions were also passed on the following subjects: collaboration of PASB with national health services in connexion with administrative practices; the status of community water supply programmes; advertising of medical products; educational needs for health personnel in the Americas; secondment of staff from Member Governments; general programme of work of PAHO/WHO covering the period 1962-1965.

With regard to the problem of malnutrition, particularly in children, the Council discussed the development and utilization of " INCAPARINA ", a product prepared by the Institute of Nutrition of Central America and Panama. This is an inexpensive vegetable mixture of high nutritional value intended to prevent protein malnutrition in economically under-developed nations. It was recommended that Member Governments study carefully the potential value and the possibilities of producing " INCAPARINA " or similar local products, and means of promoting their consumption. It is, in fact, possible to obtain similar mixtures, equally rich in vegetable proteins, by adapting production to the raw materials available in the various countries and to the people's dietetic habits.

Argentina and Chile were elected to the Executive Committee to replace Mexico and Venezuela whose terms of office had expired. The Committee also includes representatives of Brazil, Colombia, El Salvador, Honduras and the United States.

During the meeting, the United States representative announced that Congress had approved the allocation of a sum of $875 000 for the acquisition of land to be donated by his Government for a new headquarters building of the Pan American Health Organization in Washington, D.C. The Council expressed its gratitude to the United States Government and authorized the Director of PASB to accept the gift. The new building is expected to cost about $4 555 000.

Regional Committee for South-East Asia

The thirteenth session of the WHO Regional Committee for South-East Asia was held in Bandung, Indonesia, from 22 to 29 August 1960. It was attended by representatives of nine countries, and of the United Nations Technical Assistance Board, UNICEF, FAO, and a number of non-governmental organizations. Dr Saiful Anwar (Indonesia) was appointed Chairman, and Dr Kamdhorn Suvarnakich (Thailand) Vice-Chairman.

Dr C. Mani, WHO Regional Director for South-East Asia, stated in his report for the period August 1959 to June 1960 that the burden of sickness in the Region was very heavy indeed. Malnutrition and poor sanitation, both due to poverty, were the main causes of this " deplorable state of public health " in South-East Asia:

" While governments in the Region are making strong efforts to reduce poverty, through various degrees of industrialization, the sinister role of malnutrition and insanitation on the health and working capacity of the people is still not properly appreciated.

" The loss of working time is really staggering, and until government planning bodies realize this and are willing to give top priority to the improvement of these two vital conditions, this colossal drain on national economics will continue and grow steadily through the coming years of rapid industrial development."

During the period under review, WHO helped governments in the Region with 129 projects employing 238 WHO field workers. These projects were, as in previous years, mainly concerned with the control of communicable diseases, the promotion of rural health services, and the training of all categories of health staff.

Malaria eradication programmes had made progress, despite difficulties (mainly financial); adequate national staff, better training, and stronger supervision at all levels were still needed. A countrywide national tuberculosis control programme was being established in India, with WHO help, and a pilot project had been started in Thailand as a preliminary to the expansion of tuberculosis services throughout the country. As a first step towards launching national smallpox campaigns, pilot projects had been started by governments in Afghanistan, India and Indonesia, and it was hoped that these would give answers to the technical and administrative problems involved in organizing mass campaigns in South-East Asia.

Assistance in the development of epidemiological units had proved valuable in Ceylon and Indonesia, and was to be extended to other countries in the Region. The development of rural health services had been rather slow, owing mainly to shortage of staff, unsatisfactory training, and inadequate supervision, which often reduced health centres to the level of mere dispensaries. As the rural health centres developed, the need for public health laboratories was becoming more pronounced, and it was hoped to increase WHO help in this field.

In maternal and child health, WHO and UNICEF continued to help through urban and rural health centres and by developing the teaching of paediatrics and obstetrics. WHO help in environmental sanitation had been concentrated, as before, on the education and training of sanitary engineers and sanitarians and on the environmental sanitation aspects of rural health programmes. A survey had been undertaken for a sanitation project in the Greater Calcutta area, and the Regional Office was examining ways and means of helping governments with the provision of community water supplies.

A Regional Adviser in Nutrition had been appointed, and ways in which WHO might help

governments with their nutrition work were being reviewed. Assistance to medical education, by the provision of visiting professors and the award of fellowships, had continued.

The programme and budget estimates for 1962 were endorsed by the Committee. They provided for the utilization of approximately $7 500 000, made up as follows : $1 998 000 from the regular WHO budget, $885 000 from the Malaria Eradication Special Account, $1 195 000 from United Nations Technical Assistance funds, and $3 408 000 from other extra-budgetary funds.

The Regional Director was asked by the Committee to urge governments to develop health programmes for children of school and pre-school age, and, to that end, to establish closer co-operation between their Ministries of Health and Education.

The Committee also advocated pilot studies on the control of the enteric group of diseases, the possibility of eradicating filariasis, and the effect of malaria eradication programmes on the filariasis problem.

The use of liquid BCG vaccine raises serious problems in a tropical climate, and it was therefore urged that the WHO study on the use of freeze-dried BCG vaccine be completed as quickly as possible. The Regional Director was asked to see how governments might obtain freeze-dried vaccine at a reasonable cost, should it be considered suitable.

On the subject of malaria eradication, the Committee noted the financial and organizational difficulties that had prevented some countries from keeping to their programme schedules. As it was highly desirable for neighbouring countries to achieve eradication at about the same time, Member Governments were urged to take effective steps to provide sufficient funds in time to permit the completion of their programmes with the necessary speed and efficiency. The Regional Director was asked to provide an up-to-date statement on insecticide resistance in different parts of the world.

The technical discussions at the session had as their subject " The evaluation of training programmes for auxiliary personnel in the South-East Asia Region ". The points discussed included : the broad categories of auxiliaries required for health services; the nature, scope and content of training programmes; and the need for periodic formal and informal refresher courses for teachers and supervisors, as well as the auxiliary workers themselves. Considerable attention was given to such problems as the exercise of effective supervision, opportunities for advancement, and the appraisal of auxiliaries at work. The subject selected for the 1961 technical discussions is " The role of the public health department in the improvement of nutrition ".

The fourteenth session of the Regional Committee for South-East Asia will be held in Ootacamund, South India, in September 1961.

Regional Committee for Europe

The WHO Regional Committee for Europe held its tenth session at Copenhagen, Denmark, from 16 to 20 August 1960. It was attended by representatives of 27 Member States, and of a number of governmental and non-governmental international organizations. The session was opened, in the presence of His Majesty Frederik IX, King of Denmark, by Dr V. Marinescu (Romania), the outgoing Chairman.

The Committee elected the following officers: Dr J. Frandsen (Denmark), Chairman; Dr A. Sauter (Switzerland), and Dr L. Molitor (Luxembourg), Vice-Chairmen; Dr M. Juchniewicz (Poland), Rapporteur. Professor E. Aujaleu (France) presided over the technical discussions.

In his report for the period July 1959-June 1960, Dr Paul J. J. van de Calseyde, WHO Regional Director for Europe, stated that a special attempt was being made to establish a balance between country and inter-country programmes and between old and new programmes. Two new services had been started at the Regional Office, one for chronic diseases and geriatrics, and the other for epidemiology and health statistics. The latter service is taking part in studies of chronic diseases such as hypertension, cardiovascular diseases, cancer and tuberculosis.

The education and training programme continued to be the principal WHO activity in the Region. Study tours had been organized in Bulgaria, Czechoslovakia, France, and the USSR on such subjects as health administration, rural health services, and industrial medicine. The

Regional Office had also sponsored 24 international courses on a series of technical problems, including the administration of medical services, safe water supplies, and veterinary public health. There had been 530 fellowship awards during the year.

With more and more factories being started and a growing number of cars on the roads, air pollution is an increasing problem in most European towns. There can be scarcely any doubt that it is one of the main factors responsible for the growing incidence of chronic bronchitis and lung cancer, which is particularly marked in the most heavily polluted areas. The Regional Office has undertaken a study programme aiming at the standardization of instruments for measuring air pollution and methods for analysing it, as well as the establishment of international standards for maximum permissible levels of pollution, the preparation of legislation on the subject, and techniques for controlling the discharge of contaminants.

The Committee recommended that all European countries where malaria still exists should make an effort to reach the consolidation phase of their eradication programmes by 1962. Those which have had no cases of indigenous malaria for three years should ask WHO to send an evaluation team to establish the zones where eradication has been achieved. All countries of the Region were asked to make suitable contributions to the Malaria Eradication Special Account. The Regional Director was asked to continue his efforts for better comparability of tuberculosis statistics in Europe.

Two disasters had occurred during the year in Morocco, which is included in the European Region of WHO: the poisoning of 10000 persons (mostly in the Meknès area) by contaminated cooking oil, and the earthquake at Agadir. In the case of Meknès, the Regional Director stated, WHO had sent experts to investigate the causes of the disaster and had co-operated with the League of Red Cross Societies in the care of the victims, supplying staff to help set up rehabilitation centres, give treatment, and train Moroccan physiotherapists. At Agadir, the Organization provided the services of a sanitary engineer and an epidemiological expert.

During the session, the use of Russian as a working language at the Regional Office for Europe and at the sessions of the Regional Committee was recommended by the Committee. Its introduction would have to be gradual, since the additional funds required were not provided for in the 1961 budget already adopted by the World Health Assembly. The full use of Russian as a working language would not be possible until 1963.

Other topics discussed included radiation protection, rehabilitation, mental health work, and co-operation with other organizations. The technical discussions were on the subject of public health as a scientific discipline.

The programme and budget estimates for 1962 provided for the expenditure of $1 540 600 from the regular WHO budget, to which will be added, as available, funds from the Expanded Programme of Technical Assistance, the Malaria Eradication Special Account, and other extra-budgetary sources. The Committee endorsed these estimates with certain amendments, notably the addition of a credit of $33 000 for the introduction of Russian as a working language.

The next session of the Committee will be held in September 1961 at Luxembourg. The Committee accepted the invitation of the Government of the Polish People's Republic to hold its twelfth session at Warsaw in 1962.

Regional Committee for the Western Pacific

The WHO Regional Committee for the Western Pacific held its eleventh session in Manila, Philippines, from 12 to 17 August 1960. The session was attended by representatives of all Member States in the Region, except Cambodia and Laos, and of Member States responsible for territories in the Region. The United Nations, the Technical Assistance Board, the South Pacific Commission, the Rockefeller Foundation, the International Committee of Military Medicine and Pharmacy, and 15 non-governmental organizations in official relations with WHO were also represented. The meeting was attended by Dr P. Dorolle, Deputy Director-General of WHO.

The Committee elected the following officers: Dr R. C. K. Lee (USA), Chairman; Dr Ten Yoon

Fong (Malaya), Vice-Chairman; Dr O. J. M. Kranendonk (Netherlands) and Dr J. P. Martins (Portugal), Rapporteurs.

The Committee examined the report of Dr I. C. Fang, WHO Regional Director for the Western Pacific, for the period 1 July 1959 to 31 May 1960. It noted that encouraging progress had been made in strengthening national health administrations and that more attention had been paid to the need for better co-ordination and careful planning. Work for the development of comprehensive rural health services, with maternal and child health as an integral component, had continued and there was every indication that these services would expand rapidly in the coming year. Better facilities for the education and training of national personnel of all categories —still a pressing need—were planned. Experience had shown that training within the Region was relatively more economical than training elsewhere and permitted the award of a greater number of fellowships with the funds available. It was also often more useful to the fellows concerned, since it was carried out in environments with conditions and problems similar to those in the fellows' home countries.

The year's work in nursing had been encouraging, and the need for increasing nursing staff and improving the quality of nursing service was being more generally recognized.

There had been an intensification of anti-malaria work throughout the Region, and the concept of eradication was now accepted by most Member States. The results of the mass yaws campaigns and resurveys had been most satisfactory. More countries were planning or expanding tuberculosis control programmes. Smallpox had continued to decline in the countries where it was endemic, and the Governments of Cambodia, Korea and Viet Nam were vigorously pursuing mass vaccination campaigns.

In environmental sanitation, there had been an encouraging extension in the composting of municipal refuse and night-soil to produce hygienic fertilizers.

Joint planning with other agencies concerned with health had been extended, and a much closer relationship had been developed between WHO and the South Pacific Commission.

The discussions on the Regional Director's report stressed the importance of: studying countries' socio-economic conditions and potential resources as a basis for planning and establishing long-term health programmes; establishing and developing hospitals and ensuring that their bed capacity is commensurate with the population to be served; developing nutrition programmes. It was observed that inter-country educational programmes had been of great benefit and had had a considerable influence on the development of national programmes. A proposed project to supply piped water to rural and island communities was noted with interest.

The 1962 programme and budget estimates for the Region were endorsed by the Committee. These provide for an expenditure of $1 764 600 from the regular WHO budget, $1 014 200 from the Malaria Eradication Special Account, $751 200 from United Nations Technical Assistance funds, and an estimated $569 000 from other extra-budgetary sources.

The Committee noted that there had been reluctance in some quarters to bring legislation on leprosy control into line with scientific advances. It recognized that health administrations might sometimes be reluctant to adopt policies corresponding to advances in the treatment and control of leprosy because of slowness in convincing the general public, as well as professional and political groups, of the scientific viewpoint regarding this disease. It recommended that WHO should intensify its public information and educational activities in an endeavour to change age-old attitudes to leprosy and to gain acceptance of modern concepts, and suggested that leprosy should be an early subject for a World Health Day.

The Committee considered a report by the Regional Director on the malaria eradication programme in the Region. It noted that regional training activities in this field had been improved by the holding of courses at Tala, Rizal, Philippines. It also noted that two trials with medicated salt were taking place in the Region. Owing to the serious financial situation of the malaria eradication operations, Member States—and particularly those with no malaria problem—were asked to contribute generously to the financing of the world-wide malaria eradication programme.

A resolution was adopted urging Member States to give first priority to malaria eradication

programmes, and to ensure that the necessary money, personnel and materials are made available. The Regional Director was asked to continue extending and improving regional facilities for training antimalaria staff.

The Committee agreed to recommend to the WHO Executive Board the extension of the term of office of Dr I. C. Fang, Regional Director, for a further period of five years from 1 July 1961 to 30 June 1966.

The subject of the technical discussions held during the session was "The organization and administration of rural health services". It was agreed that, for the planning and assessment of such services, some form of vital and health statistical data should be available. Programmes should take into account resources in money and personnel, and local staff should be employed where possible. The rural health unit should provide both preventive and curative services, and give priority to important disease problems for which effective control measures are available. It was considered that assessment of the services is essential, but that no specific criteria can be laid down for its frequency. It was agreed that, in principle, it should be done regularly and fairly frequently.

Rural health units could be financed from central government funds, local government funds, or voluntary donations or grants. Their distribution should be based on the size of the population and the area to be served, the general administrative structure, and the readiness of the population to accept the health service. It was agreed that each health unit should be headed by a physician, and include a nurse, a midwife and a sanitarian. Certain untrained personnel, such as herb-doctors, might also be used under certain circumstances, but there was general reluctance to accept such personnel as regular members of the unit. Midwifery service was considered as a fundamental part of a rural health unit's work, and it was agreed that, where the necessary facilities are available, there should be full-time maternity services. The subject selected for the technical discussions at the Regional Committee's twelfth session is "Dental health".

After attending the session, representatives of 9 countries and territories took part in a Public Health Conference and Study Tour in Singapore and the Federation of Malaya. During the tour, which lasted from 20 August to 2 September, rural health services and field projects were visited and ideas, views and experiences were exchanged with health workers in the host countries.

The twelfth session of the WHO Regional Committee for the Western Pacific will be held in New Zealand in 1961.

Immunization programme for India

About 13.5% of India's 408 million inhabitants are infants and children of 4 and under; about 25% are between 5 and 15 years old. Diphtheria, whooping cough and tetanus cause widespread morbidity and mortality in these age groups. For example, diphtheria—also rife in rural areas—is responsible for between 2000 and 5000 admissions every year to hospitals in cities like Calcutta and Bombay, and no fewer than 84% of the cases are children between 2 and 10 years of age, while 11% are infants. Special studies have shown that tetanus and tetanus of the newborn are important causes of death in rural India. Whooping cough not only causes much suffering, but also many deaths from secondary complications.

In 1959, the twelfth session of the WHO Regional Committee for South-East Asia recommended the routine vaccination of children against all three diseases. The major obstacle to this course in India has hitherto been the difficulty of obtaining the necessary vaccines; local production is inadequate and the cost of importing them prohibitive. It has therefore been decided to expand their local manufacture with help from WHO and UNICEF as a preliminary to a countrywide immunization campaign against the three diseases.

A pilot unit for the production of the vaccines will be set up at the Central Research Institute, Kasauli. As soon as the most practical methods of preparation have been worked out, standardized and tested, other laboratories will be encouraged to adopt the approved methods and start production so that the entire needs of the country can be met step by step. At the same time, epidemiological information on the diseases

will be collected from both rural and urban areas and used to plan a practical and economical immunization programme for the whole country.

The vaccines will be manufactured at Kausali in accordance with WHO-recommended procedures, and a WHO consultant will be assigned to the project. Equipment, apart from that already available in the country, will be supplied by UNICEF.

Two workers from the Kasauli Institute are at present in Australia studying vaccine production and immunology, including the production of triple vaccine against diphtheria, whooping cough and tetanus. On their return next year they will work with the staff of the special vaccine production unit. Another worker from the Institute will be similarly trained overseas at a later date. It is expected that the Institute will be able to produce 4 000 000 ml of vaccine a year to begin with, and within three years will reach the target of 7 000 000 ml a year.

Aircraft disinsection

Until about thirty years ago, ships were the main agency whereby insects were accidentally introduced into countries from overseas. While shipping fosters the dissemination of human ectoparasites, domestic insects, and pests of agricultural products, stored products and timber, a great number of undesirable insects do not survive long sea journeys. These include species for which suitable larval habitats are not available aboard ship, or which in the adult state have a very brief existence or become such a nuisance that control measures are taken against them during the voyage. The longer the voyage, the less likely the survival of most anophelines and other mosquito vectors, provided that they are in the normally active stage during which both sexes must feed repeatedly. The males die because they are deprived of their natural food (plant juices, etc.), while the persistent biting of the females leads to control measures which reduce their numbers.

With the development of international aviation, a new situation arose. The brief flying time required for journeys taking several days or weeks by sea ensures the survival of insect stowaways, which suffer no ill effects from the flight. Moreover, aircraft are entered by a greater variety of free-flying insects of public health importance than are ships, which are exposed only to the relatively limited range of species found in urban dock areas. International airports are mostly in rural areas, where local vector insects and forestry and agricultural pests may flourish; the existence of a wide range of breeding sites near airfields favours both the entry of vectors and pests to aircraft and the establishment in the area of insects introduced from abroad.

As early as 1928, the transport of agricultural pests by airlines operating between Cuba, South America and the southern United States was having an effect on the plant quarantine situation. By 1930, the disastrous establishment of *Anopheles gambiae* in Brazil—probably by means of a fast naval vessel, although there is a definite possibility that a pioneer air service was responsible—had focused attention on health aspects of the problem. Three years later, the International Sanitary Convention for Aerial Navigation contained provisions for the disinsecting of aircraft.

The great increase in international civil air traffic and the launching of a number of mosquito eradication programmes after the Second World War led to a reappraisal by WHO of existing disinsection requirements. A comprehensive survey of the subject up to 1948 was published in the WHO Bulletin [1] and the subject was dealt with in the first [2] and second [3] reports of the WHO Expert Committee on Insecticides.

Despite considerable progress and the promulgation of spraying regulations by a number of countries and territories, the need for improving and standardizing procedures remained. This was reflected in the recommendations published in 1957 in the seventh report of the WHO Expert Committee on Insecticides,[4] which also appeared as Annex 5 to the International Sanitary Regulations published in the same year.[5] Since then, there has been growing concern over the

[1] *Bull. Wld Hlth Org.*, 1949, **2**, 155
[2] *Wld Hlth Org. techn. Rep. Ser.*, 1950, **4**
[3] *Wld Hlth Org. techn. Rep. Ser.*, 1951, **34**
[4] *Wld Hlth Org. techn. Rep. Ser.*, 1957, **125**
[5] World Health Organization (1957) *International Sanitary Regulations*, Geneva

possible reimportation of *Aëdes aegypti* following local eradication, and the introduction of resistant anophelines into territories where eradication programmes are in progress and where resistance has not yet appeared. In addition, the inception of the jet age has not only increased the risk of insects being imported but has heightened the conflict between disinsection requirements and the convenience of airline operators.

The WHO Expert Committee on Insecticides met from 19 to 24 September, in Geneva, to consider the problem of aircraft disinsection and to recommend improved, standardized and thoroughly practicable disinsecting procedures for early implementation by the International Quarantine Committee. When the Expert Committee's report is issued, it will be reviewed in the Chronicle.

Training and use of auxiliary personnel

The WHO Expert Committee on Professional and Technical Education of Medical and Auxiliary Personnel met in Geneva, from 19 to 24 September, to consider the use and training of auxiliary personnel in medicine, nursing, midwifery, and sanitation. The third report of the Committee,[1] published in 1956, covered the training and functions of nine categories of auxiliary health workers. This year, the Committee considered only the four categories mentioned above so that each might investigated more fully.

The main points discussed were: the need for auxiliaries in public health programmes; the use of auxiliaries; their training, including relation to the needs of the country, type (basic courses, on-the-job instruction), and location of training centres; content of courses; methods of teaching and learning; qualification and registration of auxiliaries; refresher courses and advanced training; the training of teachers of auxiliaries; the orientation of professional groups in the use of auxiliaries; and the follow-up of auxiliaries at work after training.

When the Committee's report is issued, it will be reviewed in the Chronicle.

[1] *Wld Hlth Org. techn. Rep. Ser.*, 1956, 109

Planning public health services

A WHO Expert Committee on Public Health Administration met in Geneva, from 1 to 6 August 1960, to discuss the planning of public health services.

Experience in planning such services in a number of countries was carefully reviewed, and a series of general principles agreed upon. Owing to the differences in social, cultural, and economic conditions in various parts of the world, the Committee could deal with the subject only from a methodological point of view. Brief studies of health planning work in Ceylon, Czechoslovakia, India, the United Arab Republic, the United Kingdom, and the USSR were presented to the Committee and will appear as annexes to its report. It was agreed that, as health planning is a developing activity, further studies are needed to extend knowledge and experience in this field. The Committee stressed the importance of health planning in relation to economic and social development and the need for the use of econometric methods for the measurement of productivity in health work.

An account of the Committee's work will appear in the Chronicle when its report is published.

Laboratory diagnosis of virus and rickettsial diseases

A course on the laboratory diagnosis of virus and rickettsial diseases was held in Czechoslovakia, from 4 September to 1 October, under the auspices of the WHO Regional Office for Europe. It was a follow-up of a seminar held in 1956 in Madrid, and courses held in London and Paris in 1957 and 1958, and was the first course conducted in Russian to be organized by the Regional Office.

Half of the course was devoted to formal lectures and laboratory exercises at the Institute of Epidemiology and Microbiology in Prague, and the remainder to practical field work in institutes and regional virus laboratories in Bratislava, Brno and Ostrava. The participants came from Bulgaria, Czechoslovakia, Poland, the USSR and Yugoslavia. There were 12 of

them in all, bringing the total number of junior virologists in European countries who have attended courses of this kind up to 59. This has certainly had an influence on the application of laboratory methods in the diagnosis of virus diseases in Europe, since at least one student from nearly every laboratory of importance in the Region has attended one of the courses.

Arthropod-borne viruses

The list of viruses carried by arthropods (mosquitos, ticks, gnats, etc.) is constantly growing. The total number already known exceeds 125, and it is certain that there are many more. One of the fundamental characteristics of these viruses is to require the intervention of an arthropod vector and vertebrate host for their maintenance in nature; with one or two possible exceptions, man is only a tangential or accidental victim. This does not mean, however, that they are of negligible importance for public health. Serious outbreaks of disease due to arthropod-borne viruses have occurred in the past, and are still occurring in many parts of the world: yellow fever, dengue, Japanese B encephalitis, Russian spring-summer encephalitis, and the "new" Kyanasur Forest disease are good examples.

A WHO Study Group on Arthropod-Borne Viruses met in Geneva, from 5 to 10 September, to consider *inter alia* problems relating to grouping and classification of these viruses, procedures for determining their presence or importance in unexplored or incompletely studied areas, their importance as producers of human and veterinary disease, and possible control measures. An account of the Study Group's work will appear in the Chronicle when its report is published.

Medical rehabilitation

A course on the medical rehabilitation of the physically handicapped adult was held in England from 19 September to 8 October, by the WHO Regional Office for Europe with the co-operation of the British Government and the International Labour Organisation, in order to help meet the urgent need for trained personnel in this field. The United Nations, the International Society for the Welfare of Cripples, the World Confederation for Physical Therapy, the World Veterans Federation, and the European Coal and Steel Community sponsored either fellows or lecturers for the course.

The course permitted participants to study the organization of up-to-date rehabilitation services, modern teamwork techniques and approaches to rehabilitation, and the treatment of significant cases of disability. The programme included a number of lectures on the general structure of rehabilitation and related services in the United Kingdom, and visits to rehabilitation centres, orthopaedic hospitals, training centres for the disabled, institutions for the treatment of special groups and for fitting prosthetic appliances, etc. After each visit, a group discussion was held on the services seen and the problems encountered.

The participants in the course came from: Austria, Belgium, Czechoslovakia, Denmark, Germany, Ireland, Italy, Portugal, Spain, Switzerland, Turkey, and the USSR. They included physicians, physiotherapists, nurses, prosthetic technicians, occupational therapists, disablement resettlement officers and social workers.

This is the second course on rehabilitation of physically handicapped adults to be organized by the Regional Office for Europe; the first was in Nancy, France, in 1957.

People and Places

Strengthening health services in Indonesia

WHO is helping the Ministry of Health of Indonesia to plan and administer an integrated and co-ordinated public health programme. This calls for an evaluation of existing health work and training programmes, a study of staffing patterns, and the formulation of administrative procedures.

WHO has appointed Dr David Penman, of the United Kingdom, as medical officer in Djakarta to help with this programme. Dr Penman is a graduate of Edinburgh University, where he also obtained his degrees in public health and in tropical medicine and hygiene. After several years in the Royal Navy, he worked as Resident Medical Officer in Malaya, and as Assistant-Director of Field Studies in a survey of general practice in Canada.

Training of malariologists

Since last year, the Institute of Malariology in Tala, Rizal, Philippines, has served as an international training centre for personnel taking part in the world-wide malaria eradication campaign sponsored by WHO. The centre is a joint undertaking of the Philippine Government, the US International Cooperation Administration (ICA), and WHO.

Dr Arthur A. Sandosham, Professor of Parasitology and Principal of the University of Malaya, Singapore, has been appointed by WHO as Co-ordinator of Studies at the Tala Institute. He brings to this post some thirty years of experience in medical education and training, and in malaria work. A graduate of King Edward VII College of Medicine at Singapore, Dr Sandosham holds a doctorate in philosophy from London University and an honorary doctorate in medicine from the University of Malaya. From 1930 to 1950 he was lecturer in biology and parasitology at King Edward VII College of Medicine, after which he joined the staff of the University of Malaya.

Tuberculosis chemotherapy

Dr H. Stott has joined the staff of the Tuberculosis Chemotherapy Centre in Madras, where a comparative study of domiciliary and sanatorium treatment of tuberculosis is being carried out under the auspices of the Indian Government, the Madras Government, the Indian Council of Medical Research, the Medical Research Council of Great Britain, and WHO.

Born at Ootacamund, India, Dr Stott studied at Cambridge University and at Guy's Hospital Medical School, London. He continued his medical education at the School of Tropical Medicine, Liverpool, Brompton Hospital, London, and the Royal Institute of Public Health and Hygiene, London. Since 1939 he has worked with the medical services in Kenya.

Insecticide resistance

Dr F. J. Oppenoorth, Scientific Administrator at the Laboratory for Research on Insecticides of the Department of Agriculture, Utrecht, Netherlands, has been appointed by WHO to co-ordinate research studies on biochemical and genetic aspects of insecticide resistance in vectors of public health importance. During this assignment he will consult with leading research workers in this field in Italy and the eastern Mediterranean area. Dr Oppenoorth has for several years been engaged in research into the physiological and genetic aspects of resistance in the house-fly to chlorinated hydrocarbon and organo-phosphorus insecticides.

Yaws control in Liberia and Thailand

A yaws control programme has been operating in Liberia, with help from WHO and UNICEF, since 1953. The initial treatment surveys, completed in 1957, indicated that approximately 19% of the population had yaws in one of its forms. However, a substantial reduction was

observed in subsequent resurveys covering the whole country. The programme is now entering the consolidation phase. Dr K. Vigors Earle, of the United Kingdom, has been appointed WHO Medical Officer to the programme, succeeding Dr H. Dirckze who is retiring. Before joining WHO, Dr Earle had wide experience in tropical medicine in West Africa, Latin America, and East Asia.

During the past ten years, the national teams working on the WHO/UNICEF-assisted yaws control programme in Thailand have examined some 19 748 000 people at initial surveys and resurveys, and treated or re-treated about 1 351 000 cases of yaws. Mrs Helen A. Patterson, of the United States, has been appointed WHO statistician to this programme, and will assist in planning yaws surveys and evaluating methods and results. Before joining WHO, Mrs Patterson worked in the statistical departments of the National Academy of Sciences in Washington, D.C., and the Atomic Bomb Casualty Commission in Japan. She holds an M.A. degree in sociology and anthropology.

Mental health

Dr Jorge Velasco-Alzaga, of Mexico, has been appointed Regional Consultant in Mental Health at the headquarters of the Pan American Sanitary Bureau, which acts as the WHO Regional Office for the Americas. Dr Velasco-Alzaga holds degrees in medicine and public health from the Military Medical School and the School of Public Health and Hygiene in Mexico City. He has also done post-graduate studies in neuropsychiatry, public health administration, mental health, and psychoanalytical training in the United States and Mexico.

Appointments at WHO Headquarters

Owing to the growing activities of WHO, it has been necessary to appoint a fourth Assistant Director-General. Professor Fred Grundy, Mansel Talbot Professor of Preventive Medicine in the Welsh National School of Medicine, has been selected for this post and will be responsible for the Divisions of Public Health Services, Health Protection and Promotion, and Education and Training. He is expected to take up his duties officially in 1961.

Dr Grundy obtained his medical degrees at Leeds University and the University of London; he is also a barrister-at-law. After five years of hospital work, he entered the public health service in England, eventually becoming Medical Officer of Health of Luton, Bedfordshire. Dr Grundy has served on many health committees in the United Kingdom, and has been Chairman of the Health Visitor Training Committee of the Royal Society of Health, Vice-Chairman of the Standing Conference of Health Visitor Training Centres, and Vice-President of the Royal College of Midwives. He is joint author with Dr J. M. Mackintosh of the WHO monograph *The Teaching of Hygiene and Public Health in Europe*, and has served as consultant to the WHO Expert Committee on Professional and Technical Education of Medical and Auxiliary Personnel.

Dr Louis Verhoestraete has been appointed Director of the Division of Health Protection and Promotion, WHO Headquarters. This recently created division groups activities in the fields of cancer, cardiovascular diseases, dental health, mental health, nutrition, and social and occupational health.

Formerly Chief, Health Promotion Branch of the Pan American Sanitary Bureau (PASB), which acts as the WHO Regional Office for the Americas, Dr Verhoestraete obtained his medical degree at the University of Louvain, and subsequently did post-graduate work in Ghent, Leiden and Birmingham. He received the degree of Master of Public Health from Harvard University in 1954. From 1942 to 1947 he was provincial maternal and child health adviser for the Belgian Oeuvre Nationale de l'Enfance. He joined WHO in 1947 as a consultant in paediatrics, and served as Chief, Maternal and Child Health, WHO Headquarters, before his transfer to PASB in 1954.